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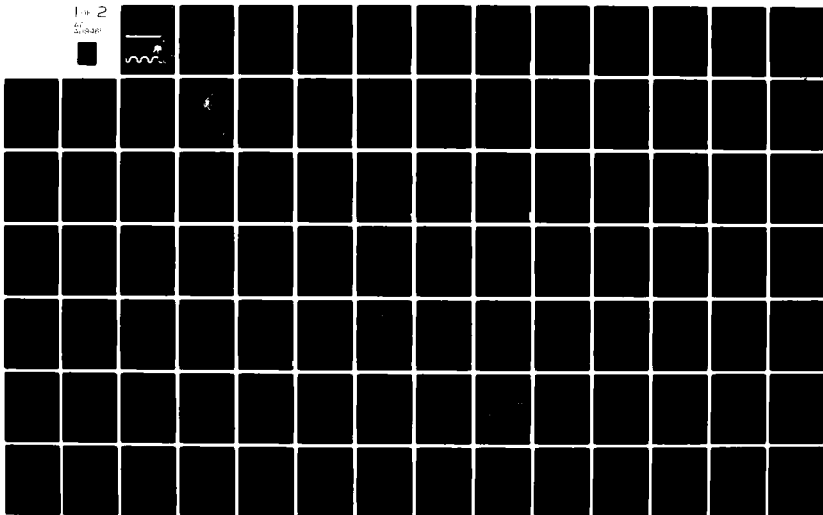
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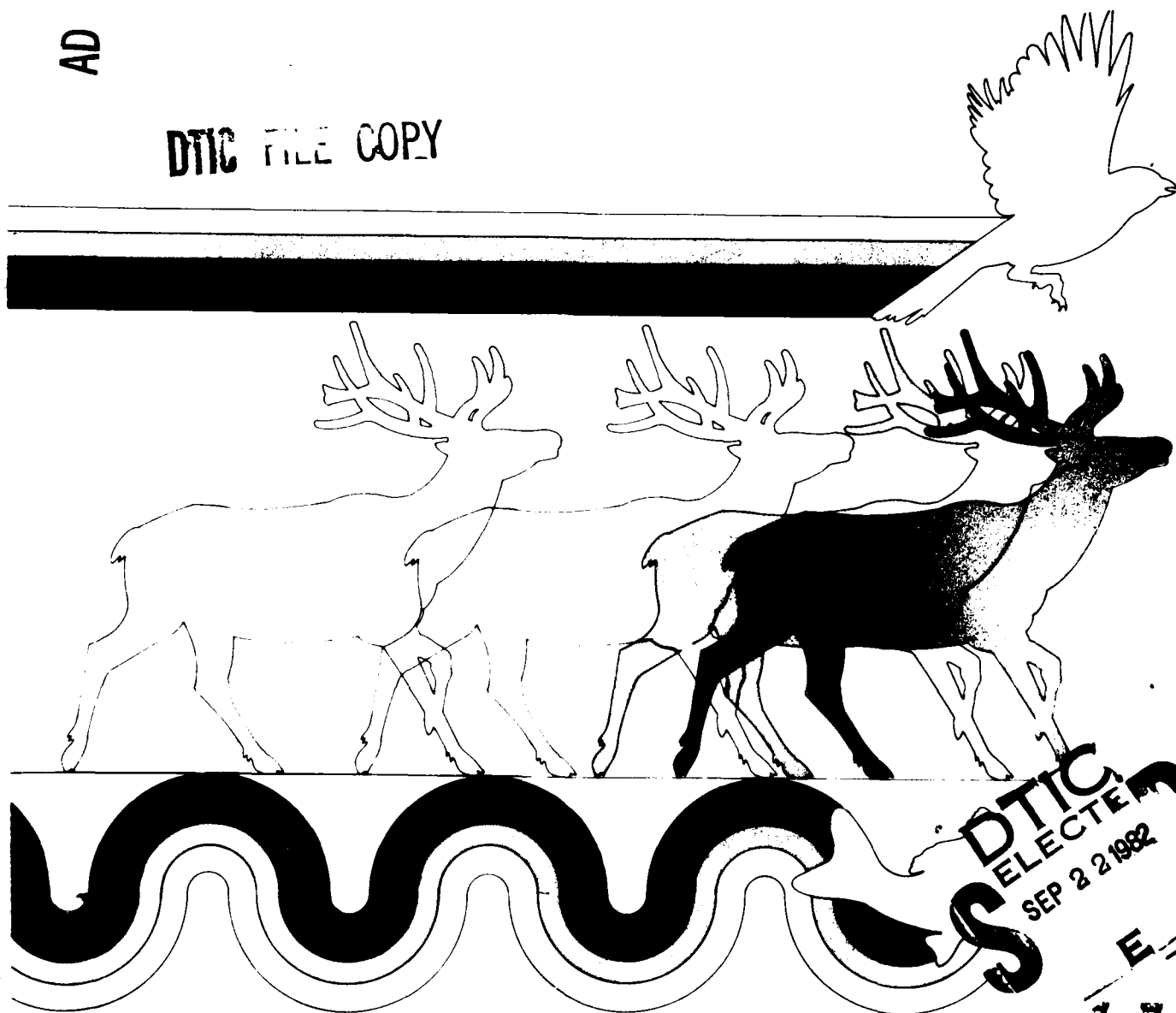
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Evaluation of Planning for Fish & Wildlife

Allegheny Reservoir,
Pennsylvania
September 1982

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Fish and wildlife resource related aspects of the Allegheny Lake project, which is located on the Allegheny River in northwestern Pennsylvania and southwestern New York, were initially described in an August, 1958 Fish and Wildlife Service (FWS) report. Information presented in this detailed FWS report was used extensively to document the subsequently issued May 9, 1961 FWS final letter report and May 9, 1961 FWS substantiating report. As delineated by the FWS, the immediate project impact area comprised a total of 8,750 ha (21,175 ac) located below maximum design flood pool elevation 416		

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(1,365 ft) and included approximately 7,905 ha (19,533 ac) of land and 665 ha (1,642 ac) of water. Fishery resources were expected to be affected over an additional 105 km (65 mi) of the Allegheny River below the dam as a result of alteration of stream flow and temperature regimes associated with project operation.

Project lands were almost equally divided between Pennsylvania and New York. Project lands purchased in Pennsylvania, subsequently were transferred by the U.S. Army Corps of Engineers (CE) to the U.S. Forest Service (USFS) and consolidated with the contiguous Allegheny National Forest to form a single management unit designated as the Allegheny Reservoir Composite which currently is managed by the USFS. Lands suitable for wildlife in New York were situated almost entirely within the Allegany Indian Reservation.

The FWS predicted that the total number of hunter man-days spent on the project impact area would decline severely with the project in place. The most severe reduction in hunting effort was predicted to occur in the Pennsylvania portion, particularly for white-tailed deer. However, the FWS predicted that the additional hunting effort expected from improved hunter access planned for contiguous areas of the Allegheny National Forest in Pennsylvania, would fully compensate the loss of hunter man-days incurred in the Pennsylvania sector. An analysis of available post-project hunter use data (both hunting license sale and deer harvest statistics) tended to verify the validity of this FWS prediction.

The FWS prediction that hunting effort in the New York sector would decline with the project in place was not supported by post-project observations. Based on hunting license sales within the Allegany Indian Reservation, estimated average annual hunter man-day use in post-project years was almost four times greater than predicted by the FWS.

The FWS recommended that the temperature of water discharge from the proposed Kinzua Dam be regulated to provide for a trout fishery in the Allegheny River tailwater in spite of a specific request by the Pennsylvania Fish Commission (PFC) for discharge temperatures appropriate for maintaining the pre-project smallmouth bass fishery. However, the CE subsequently implemented post-project water discharge regimes designed to duplicate natural pre-project river temperatures downstream, in-so-far as possible, in conformity with the PFC request. Post-impoundment creel survey estimates and investigations conducted by the PFC and FWS indicate water quality, fish communities and fishing pressure in the Allegheny River tailwater have not been adversely affected by project construction.

FWS predictions of post-project angler man-day use of Allegheny Lake have proven to be overly optimistic. A lakewide creel survey conducted by Pennsylvania State University (PSU) from April 1, 1979 through March 31, 1980, indicated that Allegheny Lake supported less than 20,000 man-days of angling per year, or some 83 percent less than the minimum FWS report prediction.

The authors of the FWS report should have considered a much smaller and more realistic area of project influence (40 to 120 km (25 to 75 mi) driving distance) -- as representing the primary source of potential anglers that could be reasonably expected to frequent the project. The overly optimistic FWS angling man-day use prediction appeared to have been further exacerbated by the failure to properly assess the potential angler use of Allegheny Lake in relation to the amount, proximity and productivity of other nearby waters (Lake Erie, hundreds of Kilometers (miles) of trout streams, etc.).

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**STUDY TO EVALUATE THE ADEQUACY AND
PREDICTIVE VALUE OF FISH AND WILDLIFE
PLANNING RECOMMENDATIONS AT CORPS
OF ENGINEERS RESERVOIR PROJECTS**

INDIVIDUAL RESERVOIR PROJECT EVALUATION REPORTS

THE ALLEGHENY LAKE PROJECT

Conducted for Office, Chief of Engineers, U.S. Army

By Sport Fishing Institute, Washington, D.C.

Under Contract No. DACW31-79-C-0005

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PREFACE

This document was prepared by staff of the Sport Fishing Institute for the U.S. Army Corps of Engineers (CE) under contract number DACW31-79-C-0005. The contract requires the compilation and comparison of pre- and post-construction data treating fish and wildlife for twenty separate CE water development projects. This report presents the findings for one of the twenty individual project evaluations.

Upon completion of the full series of twenty separate studies, a final report will be prepared which will contain an analysis of the validity of the predictive procedures used in fish and wildlife planning, and will contain recommendations for improving the planning process.

This evaluation of the adequacy and accuracy of fish and wildlife planning for the Allegheny Lake project in Pennsylvania was aided significantly by the participation and active cooperation of many individuals. Thomas W. Fleeger and John F. Ewers, CE personnel located at the Allegheny project provided post-impoundment data of value to the study. CE personnel in the Pittsburgh District Office, including Edward Smith, James L. Purdy and Michael Koryak supplied many useful documents describing both pre-impoundment and post-impoundment conditions. Ed Perry at the State College, Pennsylvania Office of the U.S. Fish and Wildlife Service (FWS) provided all available pre-construction planning documents.

FWS fishery scientist John K. Anderson, stationed at the Allegheny National Fish Hatchery, furnished valuable fishery resource information, particularly concerning pre-impoundment and post-impoundment fish communities. Pre-impoundment and post-impoundment license sale and white-tail deer harvest data was supplied by Glen W. Bowers and Kenneth L. Hess of the Pennsylvania Game Commission (PGC).

Post-impoundment hunting pressure estimates and data concerning white-tailed deer population dynamics were furnished by wildlife biologist William Shope of the PGC. Project impact area visitation and hunting pressure estimates were furnished by U.S. Forest Service personnel (USFS) including biologists Russel Hill and Phillip D. Weston.

Wildlife biologist Terry L. Moore and fishery biologist James Pomeroy, New York Department of Environmental Conservation supplied helpful information concerning project associated post-impoundment fish and wildlife management activities in New York.

Mr. Barry Snyder, President of the Seneca Nation of Indians cooperated in furnishing post-impoundment fishing and hunting license sale data for the Allegany Indian Reservation in New York. Gordon Robertson, Northeast Representative with the Wildlife Management Institute accompanied project personnel on a tour of the Allegheny project and reviewed the draft manuscript.

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SPORT FISHING INSTITUTE

PROJECT PERSONNEL

Robert Martin (Project Leader)

Norville Prosser (Assistant Project Leader)

Gilbert Radonski (Contractor's Representative)

Naomi Higgins (Project Secretary)

CONSULTANT'S REVIEW

Professional terrestrial wildlife consultative services were provided by the staff of the Wildlife Management Institute (WMI). Project personnel were accompanied by a WMI staff specialist during field reconnaissance and on on-site discussions. The terrestrial wildlife portion of the prepared evaluative manuscript was reviewed and evaluated by WMI.

INTRODUCTION

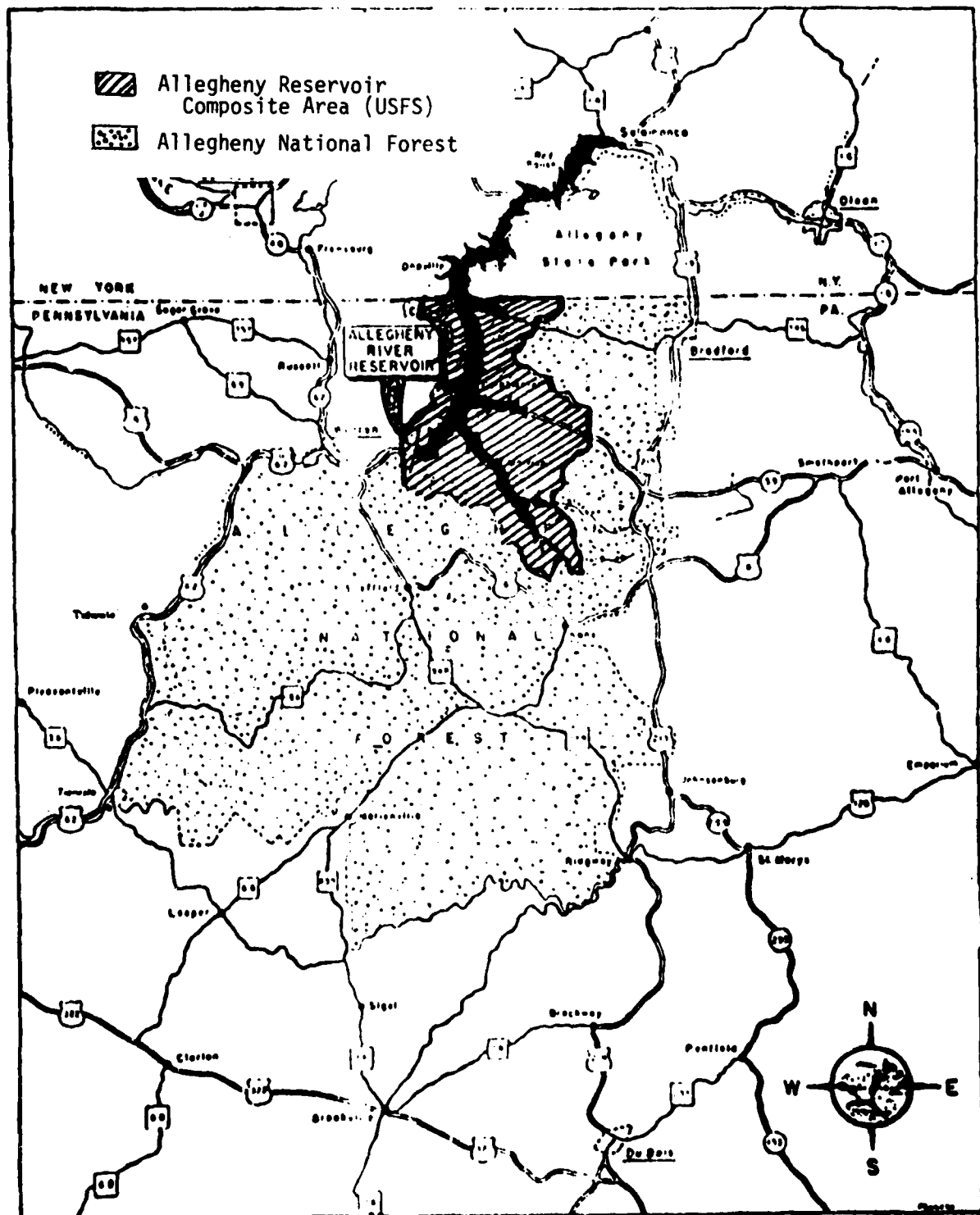
Location

Allegheny Lake is located in Northwestern Pennsylvania and Southwestern New York within a half-days travel distance of five large urban areas: Buffalo and Rochester, New York; Erie and Pittsburgh, Pennsylvania; and Cleveland, Ohio (1). Kinsua Dam, which forms the lake, is located on the Allegheny River approximately 15.6 km (9.7 mi) upstream from Warren, Pennsylvania and 319 km (198 mi) above the confluence of the Allegheny and Monongahela Rivers at Pittsburgh, Pennsylvania (Figure I). About two-thirds of Allegheny Lake at maximum summer pool elevation is located within the Allegheny National Forest located in Warren and McKean counties, Pennsylvania (2). The remaining one-third of the lake extends into Cattaraugus county, New York. Almost all the New York portion of the lake is located within the boundary of the Allegany Indian Reservation of the Seneca Nation of Indians (3). A total of 181,900 persons reside in the three counties contiguous to the lake (1980 census).

Authorization

The Kinsua Dam and Allegheny Reservoir project was authorized by Public Law 738, 74th Congress, approved 22 June, 1936 and Public Law 761, 75th Congress, approved 28 June, 1938. Public Law 228, 77th Congress, approved 18 August, 1941, amended the preceding acts "to include the Allegheny Reservoir project in accordance with the recommendation of the

Figure I. Allegheny Lake Project



Chief of Engineers in House Document Numbered 300, Seventy-sixth Congress, first session" (4).

The project was constructed to provide flood control and low flow augmentation. Although not authorized project purposes, recreation and hydro-electric power generation functions are accommodated to the extent feasible.

Physical Features

Allegheny Lake covers 4,876.6 ha (12,050 ac) at average summer conservation pool elevation 404.8 m (1,328 ft) mean sea level (msl) and includes approximately 43 km (27 mi) of the original Allegheny River bed. Maximum depth is 39.6 m (130 ft). At maximum flood pool elevation, 4,151.1 m (1,365 ft) msl, the surface area of the lake increases to 8,570 ha (21, 175 ac) and contain a total water volume of approximately 145,560 hectare-meters (1,800,000 ac feet). The five-year flood frequency elevation is 408.4 m (1,340 ft) msl. Land acquisition for the Allegheny project began late in 1959. Construction of the dam was initiated in 1961 and completed in 1965. Impoundment began in 1966.

An attempt is made to maintain the lake at summer conservation pool elevation beginning in May and continuing into July. During years of average precipitation, the lake level is gradually lowered in July and may drop 2.9 m (9.5 ft) by early September in order to accommodate downstream low-flow augmentation objectives. Although no formal winter conservation pool level is regularly maintained, the lake may be

lowered as much as 12.2 m (40 ft) by December to provide essential winter and spring flood storage capacity.

The outlet works consist of 8 sluices through the dam, 6 at invert elevation 367.3 m (1,205 ft) and 2 at invert elevation 396.2 m (1,300 ft) with their inlets protected by trash racks. The sluices are controlled by 5'8" x 10'0" slide gates which are operated hydraulically from within the dam. The upper sluices are controlled by one gate each and the lower sluices are controlled by one service and one emergency gate each. The two upper sluices are used primarily during the late spring and summer months in order to provide the highest possible water temperature released to the tailwater.

A 400,000 kw capacity power station is located immediately downstream from the south abutment of the dam. The power station is operated jointly by the Pennsylvania Electric Company and the Cleveland Electric Illuminating Company. The facility houses two reversible turbines which permits pumping water from Allegheny Lake during weekends and at night into a specially constructed 40.7 ha (100 ac) storage reservoir located some 243.8 m (800 ft) above the power-house. During peak-load periods, the water stored in the upper reservoir is released through the reversible units, then operating as turbines and generators, to produce electric power. After passing through the generators, the water is discharged either in Allegheny Reservoir or directly in the Allegheny River below the dam in accordance with downstream river flow

requirements as determined by the CE.

CE fee ownership of lands contiguous to Allegheny Lake is limited to 1,073 ha (2,651 ac) and includes only one small 100 ha (246 ac) parcel in Pennsylvania which is located in the vicinity of Kinzua Dam. The remaining portion of Allegheny Lake in Pennsylvania lies wholly within the Allegheny National Forest. Most of the property peripheral to Allegheny Lake in New York is owned and controlled by the Seneca Nation of Indians (SNI) as part of the Allegheny Indian Reservation. CE land ownership in New York is restricted to 12 highly scattered tracts ranging in size from 0.3 to 259 ha (1 to 640 ac). Each of these CE owned parcels marks a location where the lake level at full pool extends beyond the Allegheny Indian Reservation. Through a license issued by the CE in 1976, administrative control of seven of these federally owned parcels, totalling 336.2 ha (830.7 ac) was transferred to the Allegheny State Park and Recreation Commission. Another small 144.5 ha (357 ac) tract was leased to Cattaraugus County, New York in May, 1976.

Descriptive Reports

Pre-construction information related to planning, including formal reports and pertinent correspondence as well as selected references documenting continuing interagency coordination following project construction, were obtained during field visitations to the Ecological Services Branch of the U.S. Fish and Wildlife Service (FWS) at State College, Pennsylvania and from the CE District Office in Pittsburgh,

Pennsylvania. Project files were also examined at the National Archives in Washington, D.C.

Post-impoundment data were obtained from various sources, including the Pennsylvania Game Commission (PGC), the Pennsylvania Fish Commission (PFC), the New York Department of Conservation (NYDC), the U.S. Fish and Wildlife Service (FWS), and the U.S. Forest Service (USFS).

Information available prior to this evaluation was insufficient to quantify the Allegheny project-related fishery resources. It was necessary to conduct original field studies in order to acquire the data necessary to enable the present planning analysis to proceed. Under terms of the prime contract, a subcontract was awarded to The Pennsylvania State University (PSU) to conduct angler-use surveys, fish community analysis, and limited water quality studies at Allegheny Lake. The investigations covered the period April 1, 1979 - March 31, 1980. Results were included in a report which was submitted to the prime contractor in June, 1980.

WILDLIFE RESULTS AND DISCUSSION

Wildlife Resources -- Pre-impoundment Predictions

An August, 1958 report prepared by the U.S. Fish and Wildlife Service (FWS) titled "A Detailed Report on the Fish and Wildlife Resources in Relation to the Water Development Plan for the Allegheny River Reservoir, Allegheny River, Pennsylvania and New York" (5) contains the first substantive reference pertinent to the wildlife resources of the Allegheny Lake Project.

Terrestrial habitat located within the project impact area, as described in the 1958 FWS report, amounted to a total of 7,905 ha (19,533 ac), including 4,359 ha (10,771 ac) subject to permanent inundation within the summer conservation pool; 944.6 ha (2,334 ac) within the five-year flood frequency pool; and 2,601.4 ha (6,428 ac) within the maximum flood pool.

Approximately 31.6 percent of the project area was forested (20.4 percent upland woodland and 11.2 percent swamp woodland). Almost two-thirds of the wooded upland cover was located below the maximum flood pool in a narrow fringe which circumscribed the project area. The wooded uplands contiguous to the site are described as northern hardwood-hemlock forest type. The remaining areas consisted of a well interspersed mix of brush lands, 39 percent; farm land (oil fields, pasture, cropland), 25 percent; dwelling sites, 3.7 percent

and dumps, sand and gravel pits; 0.2 percent (Table 1).

The August, 1958 FWS report also included estimates of hunting pressure on selected days for white-tailed deer and upland game species on project lands for selected days in both Pennsylvania and New York (Table 2). These estimates were based on car-counts conducted sporadically throughout the 1957 hunting season. Although these data provided an indication of seasonal trends in hunting pressure, it was not possible to derive valid estimates of total hunting pressure on project lands because of the sporadic car-count schedule. Estimates of the number of hunters using project lands in Pennsylvania (2,743) was almost 30 times greater than the 98 hunters recorded in the New York portion.

The August, 1958 FWS report emphasized that the 1957 hunter-use survey did not provide a valid assessment of the actual hunting pressure that occurred on the New York sector of project lands, viz:

This great disparity in observed hunting pressure between the two states is misleading. The large observed differential is almost certainly due to the presence of the Allegany Indian Reservation in the New York section. This conclusion is supported by the hunting pressure, comparable to that in the Pennsylvania section of the project, which is known to exist in Alleghany State Park and other portions of Cattaraugus County adjoining the Reservation. Very few non-Indian hunters utilize the Reservation which comprises 87.7 percent of the total acreage of the project area in New York. Indian hunting pressure is not concentrated on specified dates, as is the case outside the Reservation; consequently, it fails to appear in its true perspective in hunting pressure surveys at specified times. The New York data reflect, therefore, only a small fraction of the hunting pressure, and the game productivity, which that section actually supports.

Table 1. -- Allegheny Lake project. Percentage composition of cover types of pre-impoundment terrestrial habitats within the designated summer conservation pool, five-year flood pool, and maximum flood pool zones

Elevation (msl)	Summer conservation pool 364.5-404.8 m (1196-1328 ft)	Five-year flood pool 404.8-408.4 m (1328-1340 ft)	Max. flood pool 408.4-416.1 m (1340-1365 ft)	Total 364.5-416.1 m (1196-1365 ft)
Area	4359 ha (10771 ac)	944.6 ha (2334 ac)	2601.4 ha (6428 ac)	7905.0 ha (19,533 ac)
	% composition	% composition	% composition	% composition
Cover type				
Wooded upland	10.8			20.4
Wooded swamp	7.5		6.5	11.2
Subtotal	18.3	3.1	2.3	31.6
Upland brush	15.1			35.0
Brush swamp	2.6	4.3	15.6	4.0
Subtotal	17.7	0.7	0.7	39.0
Old field	5.6			9.8
Pasture	1.6	1.0	3.2	2.8
Agricultural	8.5	0.3	0.9	12.9
Subtotal	15.7	1.0	3.4	25.5
Home sites	2.3			3.7
Waste lands*	0.2	0.3	1.1	0.2
Total	54.2	12.1	33.7	100.0

* dumps, and sand and/or gravel pits

Table 2. -- Allegheny Lake Project. Summary of estimates of hunter utilization of project lands in Pennsylvania and New York collected by the FWS on selected days during 1957 hunting seasons for white-tailed deer and upland game species

Type and day of season	Pennsylvania		New York	
	Season Length	Number Hunters	Season Length	Number Hunters
<u>Antlered deer only</u>	13 days		15	
1st day		797		-
<u>Antlerless deer only</u>	3 days			
1st day		423		-
2nd day		188		-
3rd day		44		-
<u>Either sex deer</u>	N.A.		1 day	
1st day	-			53
<u>Total deer season</u>	16 days	1452	16 days	53
<u>Upland game*</u>	35 days		60 days	
1st day		732		2
2nd day		-		5
3rd day		264		-
6th day		-		26
8th day		232		7
10th day		58		-
15th day		-		5
<u>Total upland game</u>		1291		45
<u>Grand total</u>	67 days	2743	76 days	98

* Includes wild turkey, ruffed grouse, squirrel (gray and fox) and cotton-tail rabbit

The project area was described in the FWS report as one of the more important white tailed deer producing and deer hunting areas in both Pennsylvania and New York, viz:

The project site is one of the more important deer producing and deer hunting areas of Pennsylvania and New York. The region serves as deer hunting territory for a large geographic area. The local hunter population is greatly outnumbered by hunters living outside the project site in western Pennsylvania, western New York and eastern Ohio, including such urban centers as Pittsburg, Erie and Buffalo. According to U.S. Forest Service surveys, deer hunters travel an average of 100 miles, one way, in pursuit of their sport on the Allegheny National Forest.

White-tailed deer density was high throughout the project area, particularly on the east side of the Allegheny River north of the dam site, viz:

In fact, it is somewhat higher than the normal carrying capacity of the forested portions of the habitat, which is the primary range of the white-tailed deer. Because of this situation deer must forage on the agricultural bottomlands along the river and its tributaries, particularly on the left side of the river in both states. These lowlands serve as a supplement daily and seasonal forage areas, especially in winter, as evidenced by the scores of deer which can be seen at selected times of the day. The particularly good interspersed forest, brush and farm land cover types in small acreage units found in most tributary drainages below and immediately above contour 1,365 on the left side of the river is highly favorable to deer.

Hunter accessibility to the proposed project area appeared to be a principal factor limiting hunting pressure and harvest for white-tailed deer, particularly on the west side of the river, viz:

The deer kill in these westerly sections is generally smaller than on the left side of the river because of less favorable road accessibility. The high deer pop-

ulation of the project area and environs probably will not increase, though hunting pressure may become more intense.

The population density of black bear within the vicinity of the project was considered to be low, viz:

The bear population is low in the forested zone peripheral to the project area. It probably does not exceed one animal per 20 square miles and is even more sparse in the project area owing to the relatively larger acreage of non-forest land in the latter location than in the former. The present occurrence of the bear within the project area is undoubtedly confined mostly to occasional foraging of individuals into the open bottomlands from adjacent forested hill land.

In spite of the low abundance of black bear it nevertheless was considered to be an important component of the wildlife resources, viz:

The annual legal bear kill unquestionably ranks last among the game species in and adjoining the project area, but the status of the bear as a game animal ranks much higher than numerical kill indicates. Because of its scarcity, the species attracts hunter interest far above its abundance. Hunters throughout Pennsylvania, western New York and eastern Ohio join with local hunters for an annual share of the kill. Barring changes in hunting regulations and drastic alteration in the habitat, the productivity of the bear population and the hunting pressure should continue at least at current levels.

The status of the wild turkey, ruffed grouse and squirrel populations was described in the August, 1958 FWS report as follows:

The wild turkey, once extirpated from this area, has become re-established in both states with the assistance of stocking programs over the past several years. The species is now fairly abundant on the left side of the river, and though at a lower level, the population of the right side is increasing. While the annual kill does not approach the size of the deer kill, hunters have an interest in this game bird second only to that in deer....The birds inhabit the

forested upland, but regularly frequent the roadways and clearings. Many turkeys utilize the river bottomlands and tributary valleys in the course of daily cruising in search of food and water. These open and brushy lands, notably on the edges near extensive forested tracts, serve as nesting territory also..... Ruffed grouse and gray squirrels are sufficiently numerous to support all the hunting pressure which they receive. Utilization of these species is somewhat lower than that of deer, wild turkeys and possibly bears....Barring drastic changes in habitat through human influence, population levels of the wild turkeys will probably increase, and grouse and gray squirrel should maintain present population levels, with a possible increase in the squirrel population. Hunting pressure on all three species, particularly on the turkey, will probably increase.

The abundance of cottontail rabbit was limited by the relatively small amount of preferred brush and farm land cover types available within the project area. Hunting pressure for cottontails appeared to be greater in the New York sector of project, particularly within the Allegany Indian Reservation. Little change was anticipated in the status of cottontail rapid abundance and/or hunting pressure.

Waterfowl, woodcock and shore birds were found in small numbers within the project area primarily as migrants. The size of the breeding population was low, viz:

The project area is not an important waterfowl, woodcock or shore bird breeding habitat. The Allegheny River and its feeder stream network, like many water courses in the region, support a small wood duck breeding population. The breeding populations of other migratory game birds appear so small, however, that they must be categorized as negligible in comparison with most game populations in the area. Woodcock, shore birds, geese and other species of ducks in small numbers use the area briefly in migration as a resting area enroute to breeding and wintering grounds north and south....Hunting pressure is low because of the brief occupancy by

waterfowl and shore birds in the fall migration. The size of transient and resident population of migrating species is not expected to increase appreciably.

The most important furbearer species common to the project area were beaver, muskrat, mink and racoon. Less important species included skunk, weasel, fox and opossum. For the most part, the furbearers were confined to the lands immediately adjacent to the Allegheny River and tributary stream. The quality of the available riparian habitat was described as follows:

None of this stream bank habitat supports the abundant populations of fur bearers found on well-established marsh habitat of equal acreage, but it compares very favorably with similar-type habitat outside the project area which supports good fur bearer populations. Agriculture is not intensive in the bottomlands of the project area, and hence, the vegetative cover and food available to fur bearers and to their animal food species exist in greater quantity and distribution than in intensively farmed regions. Fur trapping by local residents in and adjacent to the project area is extensive...Harvest of fur bearers, particularly muskrats and minks, should continue at present levels.

The August, 1958 FWS report predicted extensive adverse impacts on wildlife habitat for the completed project. In addition to the loss of more than 526 ha (1,300 ac) of existing streams, some 4,330 ha (10,700 ac) of previously available terrestrial habitat below the summer conservation pool would be affected by permanent and/or extensive periods of inundation each year. Little vegetation of value to wildlife was anticipated for that area. All existing vegetation was to be removed for project purposes from another 364 ha (900 ac) located between the top of the summer conservation pool and elevation 406.3 m (1,333 ft). Only water-tolerant vegetation of little value to wildlife was expected to

exist in the cleared area.

Vegetative changes in the area between the top of the 5-year flood frequency pool and the maximum flood pool [2,601.4 ha (6,428 ac)] were expected to be influenced more by post-impoundment land ownership and land use patterns than by short periods of intermittent inundation. The August, 1958 FWS report appeared to be ambivalent concerning future land use patterns, viz:

Most land between the 5-year frequency level, contour 1,340, and contour 1,365, including the entire Allegheny Indian Reservation, will be secured in flowage easement rather than in fee. Some of the land will remain in present ownership, some will change. In both cases, an undetermined acreage will be subject to change in land use. It would seem that the overall trend will be toward less intensive use of lands now being farmed, resulting in reversion of an undetermined number of land parcels. In Pennsylvania this trend may be more pronounced in the lower sector of the zone, between the 2-5 year flood frequency levels (1,355-1,340 feet), all of which will be acquired in fee. In New York probable trends are obscured at present because a large portion of the 1,333-1,365 contour zone is, and will continue to be, in Indian ownership. The use to which the Indians put land under flowage easement will influence the pattern and status of cover types. Agricultural use, slight at present, may decrease. It may, however, increase with a consequent reduction in currently unfarmed brushy land parcels, should the Indians decide to intensify farming activity or grant more agricultural leases to non-Indian tenants than exist at present.

Although not expressed quantitatively, the FWS report broadly evaluated probable impacts of project construction on wildlife resources. Construction of the project was not expected to affect either population density or hunting pressure intensity for black bear. Considerable adverse impact on white-tailed deer populations was anticipated, viz:

The white-tail deer, however, will be affected to the extent that the river valley and its tributaries will be wholly uninhabitable below contour 1,267 and most probably below contour 1,328. Changes in vegetation between contours 1,328 and 1,333 will reduce the deer carrying capacity of this zone significantly. Deer population trends in the 1,333-1,365 ft. zone are difficult to predict now because of the obscured land use picture under flowage easement mentioned previously. Sizeable reduction in this large acreage of bottomland deer habitat should greatly intensify the problem of high deer population on upland range, particularly on the left side of the project area on both states.

In addition to adverse effects on deer populations resulting from the physical loss of habitat, project occasioned changes in the existing road network was expected to impact deer management efforts, viz:

Deer herd management in these sections, exclusive of current state regulatory practices, may be facilitated or complicated depending on the location and extent of the proposed road net in these areas. The road net will determine the accessibility of the range to hunters and will, therefore, influence the annual deer harvest. Removal of existing roads below contour 1,365, eliminating present access to upland deer and other game habitat from the direction of the river and its tributaries below this contour, underscores the importance of proper relocation of the road system. This need is further emphasized by the removal of all hunter camps below contour 1,365. Aside from the loss to occupants of these seasonal-use dwellings from the recreational standpoint, this removal, as in the case of defunct roads, eliminates an important segment of hunter-use of upland game around the project area. Proper road relocation will help offset this loss of upland game harvest.

The impact of the project on upland game species was described as follows:

Ruffed grouse and gray squirrel range adjoining the project probably will not be affected significantly by project operations. Existing habitat below contour 1,328 and probably below contour 1,333, will be rendered useless for occupancy by these species. The suitability of habitat between

contours 1,333 and 1,365, as in the case of deer, cannot be predicted adequately at this time. Considered solely on the influence of inundation, this zone will probably support smaller grouse and squirrel populations than presently exist.

The effect of the project on the wild turkey must be appraised essentially in the same manner as outlined for grouse and squirrel. The loss of good turkey habitat below contour 1,333 within the tributary drainages of both states, and especially in Pennsylvania, will be significant to the population resident in the zone below and immediately above contour 1,365.

Wood duck, the principal waterfowl species indigenous to the project area, were expected to suffer extensive habitat loss as a result of inundation of many miles of streams by the impoundment of Allegheny Lake. Use of Allegheny Lake by migrant waterfowl species was expected to be minimal because of the lack of sufficient food, viz:

Transient waterfowl can use the reservoir pool as a temporary resting area regardless of its elevation during the spring and fall migrations. Without management practices designed to supply food plants accessible to ducks, little food will be available during their temporary occupancy, spring or fall. Should water level manipulation offer the opportunity for establishing desirable foods, or if certain food species become established naturally in the zone bounded by contours slightly below and above the 1,328-1,333 zone at points around the project area, accessibility of this food to waterfowl would be hampered or prevented if the water level were much below that zone. Thus, the creation of a larger water surface than currently exists would not necessarily increase the present level of occupancy of migrating ducks, nor would it automatically create required habitat for breeding populations of waterfowl. The value of the area to waterfowl and waterfowl hunters as a reservoir rather than as a network of river and tributary streams, thus may not change significantly in view of these contingencies.

Severe project-occasioned impacts on furbearer population was predicted, viz:

The combination of water level fluctuations and the removal of timber and brush below contour 1,333 will almost certainly eliminate essential furbearer habitat along more than 70 miles of streams below this elevation. Above contour 1,333 the future of furbearer populations is uncertain at this writing for the reasons mentioned in previous discussions of upland wildlife effects.

The FWS report, while acknowledging the need for wildlife resource mitigation, was pessimistic concerning the possibility of adequate "in kind" replacement of anticipated wildlife resource losses, viz:

Some form of compensation for losses of fish and wildlife values, as well as species, existing within the influence of the proposed project area, must come about by means of integrated planning and implementation of plans by organizations who have responsibility for managing the reservoir.

With construction of the proposed project, replacement in kind of each specific fish and wildlife value, wholly or partially destroyed, is impossible. These values are primarily recreational, economic, social and aesthetic. Many segments of the human population living within a radius of 200 miles or more of the project area are interested in it in its present condition.

However, the FWS report suggested that partial mitigation of project occasioned losses could be accomplished by developing subimpoundments above the 5-year flood pool contour, viz:

Since replacement of fish and wildlife values in degree and kind is unattainable, mitigation of losses must take the form of substitution of areas, species and values to offset, in part, those wholly or partially destroyed... These losses could be mitigated by management of selected tracts above this contour on and adjacent to the project area primarily for the benefit of waterfowl and secondarily for furbearers and sport fishes.

These areas could be developed by construction of sub-

impoundment so located as to create pools of proportionately large acreage in comparison to depth. After establishment of aquatic vegetation, and installation of management practices such as seeding cultivated grain crops and water level manipulation, the resultant small marshes should provide suitable resting and feeding areas for migratory waterfowl. This habitat also would be suitable for the propagation of furbearers and fish. Hunting and fishing in season would be permitted.

The proposed sub-impoundments would serve at least two other worthwhile purposes. They would function as sedimentation reservoirs by retarding accumulation in the main reservoir of eroded soil from the watersheds of impounded streams. Secondly, they would provide aesthetic advantages offsetting to some extent the unsightly barren areas resulting from project construction on sizeable acreages between contours 1,267 and 1,328. It is believed the general public, including sportsmen, would welcome installation of such sub-impoundment areas.

Nine specific sub-impoundment sites located in the New York sector of the project impact area were subsequently recommended for acquisitions and development. These areas comprised a total of 810 ha (2,002 ac) including 397 ha (981 ac) of water and 413 ha (1,021 ac) of surrounding land as follows:

Each sub-impoundment management unit would consist of the impoundment proper and an additional acreage of peripheral land adequate to meet wildlife needs, including accessibility from the proposed road network and control of public access to the ponds. Lands needed for these areas in addition to those scheduled for acquisition under project plans are owned by the Seneca Indian Nation and by private individuals; the larger share being owned by the Seneca Nation. Preferably such lands would be acquired in fee, although long-term and comprehensive leasing arrangements could be satisfactory.

The FWS report indicated that plans and specifications for the sub-

impoundment were under development. Land acquisition and development costs of the sub-impoundments were to be borne by the CE. The state of New York would be responsible for their subsequent maintenance, viz:

Preliminary structural specifications and estimates of the cost of all the proposed sub-impoundment projects are being prepared. The planning job is progressing well, but is not sufficiently advanced for inclusion in this report. The overall preliminary plans will be presented as an appendix to this report upon completion.

It should be stated that these plans are being developed with the understanding that the Federal Government will bear the entire cost of acquiring the needed land and constructing the sub-impoundments, and New York State will assume the subsequent responsibility of management and maintenance of the areas under proper legal authority.

Other beneficial wildlife resource-related recommendations contained in the FWS report included the following:

(a) Oil and gas wells occur within the project boundaries. In order to prevent seepage from the wells which are taken out of production, proper sealing should be accomplished. Leakage from improperly sealed wells would result in pollution which could affect fish and wildlife populations of the reservoir and downstream areas.

(b) A General Plan, pursuant to Section 3 of the Act of August 14, 1946 (60 Stat. 1080), be entered into by the Executive Director of the Pennsylvania Game Commission, the Executive Director of the Pennsylvania Fish Commission, the Commissioner of the New York Conservation Department, the Secretary of the Army, and the Secretary of the Interior to provide for administration of appropriate portions of the project lands and waters for fish and wildlife management purposes.

(c) Lands and waters in the project area be open to free use for hunting and fishing, except for sections reserved for safety, efficient operations, or

protection of public property.

(d) Leases of Federal land in the project area stipulate the right of free public access for hunting and fishing.

May 9, 1961 FWS Report

The final FWS report was released May 9, 1961. This report, which served as the final FWS statement concerning project fish and wildlife resources, consisted of a brief (5-page) letter report accompanied by a more comprehensive report containing substantiating data prepared in conjunction with the Pennsylvania Game and Fish Commissions and the New York Department of Conservation (6).

The major emphasis of the May 9, 1961 FWS letter report concerned anticipated project impacts on fishing man-day use and associated monetary values. Only a few paragraphs of this 5-page FWS letter report dealt specifically with terrestrial wildlife resources.

Loss of hunting opportunity expected from project implementation was described in the May, 1961 FWS letter report as significant. It was suggested by the authors of the report that anticipated post-project losses of hunting opportunity could be absorbed by improving access to contiguous lands owned by the U.S. Forest Service, viz:

Significant loss of hunting opportunity will result from project construction. One means of offsetting this loss would be to provide roads into presently inaccessible portions of the Allegheny National Forest. We understand from you that the proposed relocation of Pennsylvania traffic routes 59 and 346 will follow the general alignment of a road proposed by the U.S. Forest Service to provide needed access to the

ridge area east of the reservoir between Sugar Run and Willow Creek valleys. This, together with such forest products harvest roads as may possibly be built following construction of the major traffic route, should make it possible for the loss of hunting opportunity to be absorbed in the project vicinity.

The only measure recommended for mitigation of anticipated habitat loss was described as follows:

To partially offset the loss of edge effect between cleared lands and forest as well as particular values inherent in the bottomlands to be inundated by the reservoir, it would be desirable that your master use plan, as coordinated with the various agencies, give favorable consideration to management by fish and wildlife agencies of suitable project lands, including such provisions as may be feasible to mitigate the loss of the non-forested bottomland areas.

However, wildlife resources were discussed in more detail in an addendum to the May 9, 1961 FWS letter-report titled, "Substantiating Data for a Conservation and Development Report on Fish and Wildlife Resources: Allegheny River Reservoir, Pennsylvania and New York" (7).

The general area of the project was described in the FWS substantiating report as an important recreational area in both Pennsylvania and New York, viz:

Sections of Pennsylvania and New York within and adjacent to the reservoir site are important recreational areas. The Allegheny National Forest, containing approximately 470,000 acres, lies adjacent to the left bank of the Allegheny River in Pennsylvania. In New York, the boundary of Allegany State Park, comprising 58,266 acres, lies in close proximity to the left bank. The reservoir will affect minor portions of both publicly-owned areas, 84 acres of the State Park, 1684 acres of the National Forest. Major portions of the Cornplanter Indian Grant in Pennsylvania and the Allegany Indian Reservation in New York also

will be affected by the project. Indicative of the recreational value of this valley, cabins and summer cottages are located within the reservoir area.

As defined in this FWS substantiating report, the immediate project impact area was restricted to a total of 8,570 ha (21,175 ac) located below maximum design flood pool elevation 416 m (1,365 ft). The impact area included approximately 7,905 ha (19,533 ac) of land and 665 ha (1,642 ac) of water (Allegheny River and tributaries). Project lands were almost equally divided between Pennsylvania and New York. The Pennsylvania portion consisted of 3,665 ha (9,055 ac) of land and 287 ha (709 ac) of water and the New York portion included 4,240 ha (10,478 ac) of land and 378 ha (933 ac) of water (Table 3).

Land ownership patterns within the project impact area differed substantially in Pennsylvania and New York, viz:

Of the approximately 9,055 acres of land in the Pennsylvania portion, 6,807 acres are privately owned, 1,604 acres are contained in the Allegheny National Forest, and about 644 acres lie within the Cornplanter Indian Grant. In New York the pattern differs greatly. Of the 10,478 acre total, about 9,077 acres are within the boundaries of the Allegany Indian Reservation, approximately 84 acres fall within the Allegany State Park, and about 1,317 acres are in private ownership.

Pre-impoundment wildlife habitat within the project impact area was described as follows:

The proposed maximum flow line of the Allegheny Reservoir site contains an excellent interpersation of wildlife habitat types. About 14 percent of the 21,175 acre area is in agricultural use, about 9 percent is occupied by old fields, 63 percent in brush and woodlands, and water, roads, town, etc., occupy about 14 percent. About 11 percent of the agricultu-

Table 3. -- Allegheny Lake Project. Pertinent pre-impoundment terrestrial and water area relationships in project impact area

Elevation (msl)	Pennsylvania				New York				Total	
	Indian Reservation	Ha	Ac	Total	Indian Reservation	Ha	Ac	Total	Ha	Ac
<u>Max. flood pool</u>										
364.5-416 m (1196-1365 ft)										
Land	261	644	9,055	3,665	3,654	9,028	4,240	10,478	7,905	19,533
River	0	0	709	287	378	933	378	933	665	1,642
Total	261	644	9,764	3,952	4,031	9,961	4,618	11,411	8,570	21,175
<u>Five-year flood pool</u>										
404.8-408.4 m (1328-1340 ft)										
Land	6	16	650	263	575	1,420	681	1,684	945	2,334
River	0	0	0	0	54	133	54	133	54	133
Total	6	16	650	263	229	1,553	735	1,817	998	2,467
<u>Summer conservation pool</u>										
364.5-404.8 m (1196-1328 ft)										
Land	47	117	2,011	814	2,298	5,678	2,858	7,062	3,672	9,073
River	0	0	709	287	231	570	231	570	518	1,279
Total	47	117	2,720	1,101	2,529	6,248	3,089	7,632	4,190	10,352
<u>Clearing zone</u>										
404.8-406.3 m (1328-1333 ft)										
Land	2	5	285	115	236	583	269	665	384	950
River	0	0	0	0	21	53	21	53	21	53
Total	2	5	285	115	257	636	290	718	405	1,003

ral area, 8 percent of the old field area, and 27 percent of the brush and forested area lies in the New York portion of the project site.

Typical of the region, a preponderance of the reservoir area is forested. Also typical of valley bottoms but atypical of the region as a whole is the comparatively large amounts of agricultural land and old (abandoned) fields in the area. An aerial view of the vicinity reveals that virtually all of the open lands in the project vicinity are found on the valley floors.

It would be difficult to over emphasize the importance of open areas to the maintenance of many wildlife populations in a region predominantly forested. Lands such as these greatly increase the populations of practically every species of forest game indigenous to the area. It goes without saying that open lands are also essential for the maintenance of huntable populations of farm-game species.

The May 9, 1961 FWS substantiating report provided both with-the-project and without-the-project estimates of the average number and monetary value of recreational hunting man-days anticipated to occur annually within the project impact area over a designated 50-year economic project life. Assigned monetary values included a \$3 per trip value for white-tailed deer hunting, \$3 per trip value for wild turkey hunting, and a \$1 per trip value for small game hunting. These values fell within the range of values presented in the "Interim Schedule of Value for Recreational Aspects of Fish and Wildlife," adopted by the Inter-agency Committee on Water Resources (8).

The authors of the May 9, 1961 FWS substantiating report differentiated between recreational hunting, as would chiefly occur on non-Indian Reservation lands, and sustenance hunting practiced by Indians on reser-

vation lands, viz:

To a greater or lesser extent, virtually all these lands sustain some degree of hunting pressure; however, the type of hunting varies with ownership. The hunting use sustained by the private and public lands of the area is a form of recreational hunting subject to all the normal restrictions of the sport. On the other hand, the hunting and game harvest occurring on reservation land contributes directly to the livelihood of its residents. Because of this distinction, and the fact that the values used herein pertain only to the "Recreational Aspects of Fish and Wildlife", no attempt will be made to evaluate the non-recreational type of hunting. All known recreational hunting on reservation lands will be evaluated, however.

Without-the-project, hunting man-day use within the project impact areas was expected to increase overtime, particularly on lands located in

Pennsylvania, viz:

Based on survey data, approximately 368,000 licensed hunters presently reside within known drawing distance of the project area. To this number may be added approximately 64,000 unlicensed children and retired adults who also hunt. Due to land ownership patterns, virtually all of these hunters reside and hunt in the Pennsylvania segment of the reservoir area. With anticipated population growth in this region, it is expected that an average of about 470,000 hunters will be available to utilize the wildlife resources of the general area during the period equal to the economic project life.

White-tailed deer, although less abundant within the project area than in former years, was characterized as the most important games species, viz:

From the standpoint of hunter interest, the white-tail deer is the most important game species presently found on the project area. Because of natural changes in vegetative types in this general region, their numbers have been declining in recent years. At the same time, hunting pressures have been increa-

sing. At one time deer were numerous enough on the Allegheny National Forest to interfere with sound forest management practices. However, according to Forest Service personnel, the deer herd could be maintained at present levels on the National Forest consistent with accepted forest management practices, and therefore, to do so is a current management objective. Except for the fact that long range plans for management of private forest lands in the Pennsylvania sector of the general area have not been developed, essentially the same conditions prevail with respect to the average number of deer these areas will support during a period equal to the economic project life.

Hunting pressure for white-tailed deer was not expected to increase in future years, viz:

The deer range encompassed by the Pennsylvania section of the project area, exclusive of the Cornplanter Reservation, presently sustains about 1930 man-days of deer hunting annually. Unless management techniques are developed to increase the carrying capacity of this range significantly, without adversely affecting other equally valuable forest resources, this figure also represents the degree of use this resource would receive on an average over the life of the project. Based on the accepted valuation for deer hunting, this resource is valued at \$5,790.00 annually.

It is estimated that approximately 180 man-days of recreational deer hunting is done on that portion of Allegany Reservation lands which lie in the reservoir and approximately 309 man-days on the other project lands in New York State. Computed at the same rate, these resources would be valued at \$600.00 and \$927.00 respectively each year.

Hunting effort (man-days) expected for wild turkey was expected to double in the Pennsylvania sector of the project during the designated 50-year economic life of the project, and to quadruple in the New York sector, viz:

The second most important game animal species indigenous to the area is the wild turkey. On non-reservation lands in the Pennsylvania segment of the reservoir area, this species now provides about 780 man-days of hunting recreation annually. With expected increases in the numbers of hunters who would use this area, coupled with anticipated shifts in hunting pressures, it is conservatively estimated that hunter days in relation to this species will average twice the present use during the next 50 years. Thus an expected 1,560 man-days of turkey hunting would be expended, resulting in an average annual value of \$4,680 for this resource.

Two New York counties, Cattaraugus and Allegheny, were reopened to turkey hunting during the 1960 season. Approximately 90 hunter-days were expended on the project area during that season. This rate of use may also be expected to approximately quadruple during the ensuing 50 years. At this expected rate of increase in hunting pressure, the turkey resources on non-reservation lands in New York State would provide an average recreational hunting value of about \$540.00 annually.

Hunting effort directed to small game species was expected to increase by some 20 percent, viz:

Collectively, cottontail rabbits, gray squirrels, and grouse attract approximately 670 days of hunter use annually on non-reservation lands in the Pennsylvania section and about 160 man-days in the New York section. Assuming no major catastrophes in general range conditions, these species could support hunting pressures many times greater. However, hunter use of these species is not expected to increase greatly in this area during the span of years immediately ensuing. Assuming an increase of 20 percent, the annual sport hunting value of these resources would be estimated \$800.00 in the Pennsylvania section and \$190.00 in the New York Segment.

Hunting effort for black bear on project land was not evaluated, viz:

The black bear is also indigenous to the vicinity of the project; however, since its use of project lands is probably incidental, hunter-use of this

species will not be evaluated.

The May 9, 1961 FWS substantiating report provided only minimal discussion of the anticipated effects of project construction on terrestrial wildlife habitat and associated hunting opportunity. No consideration was afforded to possible adverse impacts on wildlife habitat located within the 5-year flood pool zone or to other lands situated above the summer conservation pool [elevation 404 m (1,328 ft)] subject to periodic inundation. Predictions of adverse impacts on wildlife habitat and hunting opportunity were restricted to lands expected to under-go prolonged annual inundation, viz:

Development of Allegheny Reservoir will result in physical loss of approximately 10,640 acres of wildlife habitat due to prolonged annual inundation. Of this, only about 6,534 acres presently support recreational hunting use, since about 3,350 acres of the affected area lie within the Allegheny Reservation and about 527 acres lie within the Cornplanter Reservation where recreational hunting is practically non-existent. The loss of recreational hunting due to land inundation is estimated to about 1,600 man-days of deer hunting, 380 man-days of turkey hunting, and about 378 man-days of small game hunting annually.

A summary of FWS predictions of anticipated habitat loss attributed to project construction is presented in (Table 4). Overall losses of terrestrial wildlife habitat within the project impact area were predicted to amount to 4,233 ha (10,640 ac), or approximately 54 percent of the total project impact area. Habitat losses were expected to be more severe in the Pennsylvania sector (78 percent) than in New York (33 percent). Implementation of the project also was expected to result in a substan-

Table 4. -- Allegheny Lake Project. Predicted changes in the composition of land ownership and area of terrestrial wildlife habitat within the project impact area as a result of project construction

Land ownership	Pennsylvania		New York		Total	
	No. ha	No. ac	No. ha	No. ac	No. ha	Percent
<u>Without-the-project</u>						
Indian reservation	261	644 ^{1/}	3,654	9,028 ^{2/}	3,914	49.5
Non-reservation	3,404	8,411	586	1,450	3,991	50.5
Total area	3,665	9,055	4,240	10,478	7,905	100
<u>With-the-project</u>						
Indian reservation	47	117	2,298	5,678	2,345	63.9
Non-reservation	767	1,894	560	1,384	1,327	36.1
Total area	814	2,011	2,858	7,062	3,672	100
<u>Loss ^{1/}</u>						
Indian reservation	214	527	1,356	3,350	1,589	37.5
Non-reservation	2,637	6,517	27	66	2,644	62.5
Total area	2,851	7,044	1,383	3,416	4,233	100
Percent habitat loss		78		33		54

^{1/} Conplinter Reservation

^{2/} Allegany Reservation

tial realignment of the composition of land ownership remaining within the project impact area. With the project in place, the proportion of project lands controlled by Indian nations (primarily within the Allegany Indian Reservation in New York) would increase from 49 percent to 63 percent and the proportion of lands remaining in non-Indian ownership would decline from 51 percent to 37 percent. This change in the pattern of land ownership would further reduce recreational hunting on the remaining project lands, as recreational hunting intensity was historically lower on Indian reservation lands.

However, the May 9, 1961 FWS substantiating report suggested that changes in land use associated with project construction would tend to partially offset expected adverse impacts on wildlife habitat within the project impact area, viz:

Two major changes will occur in and adjacent to the reservoir area which will offset, to an undetermined extent, the loss of the favorable influence the Allegheny River valley now exerts on the wildlife population of the surrounding area: (1) reservoir clearing between the summer pool elevation and elevation 1,333 will provide about 950 acres of open area distributed uniformly throughout the valley area; and (2) the reversion of open land to woody growth, resulting from land abandonment in the reservoir area, will be highly beneficial to many forms of wildlife particularly early in the project life.

Also, an increase of hunting effort on remaining project lands was anticipated by the authors of the May 9, 1961 FWS substantiating report, viz:

Since project construction is not expected to significantly alter the drawing radius of area hunters, the loss of productive wildlife habitat will place

additional hunting pressure on the remaining resources of the area.

A recapitulation of FWS predictions of with-the-project hunting use is presented in Table 5. The total number of hunter man-days on the project impact area was expected to decline by approximately 46 percent with the project in place, as compared to a 54 percent reduction in habitat. Hunting effort for white-tailed deer was expected to suffer the greatest decline, some 66 percent, as compared to a predicted decline in hunting effort of 38 percent for small game and a 22 percent decline for wild turkey hunting effort.

The May 9, 1961 FWS substantiating report provided a brief discussion of measures which could be undertaken to partially offset the predicted loss of hunting effort on project lands, as follows:

Due to the existence of the Allegheny National Forest, much of the reservoir shoreline in Pennsylvania will be bounded by public lands. Because National Forest lands are available for public use, they will enhance the recreational value of the reservoir considerably. Additional selected lands should be purchased along the periphery in order that developments surrounding the area can be satisfactorily regulated through public ownership. The details as to exact extent and cost of required land acquisition have not yet been determined...

Development of Allegheny Reservoir will have both detrimental and beneficial effects on wildlife resources. The uniform clearing of 950 acres of land on the reservoir periphery will provide the means by which good interspersed wildlife habitat can be provided throughout a considerable length of the reservoir area. However, in order to maintain this cleared area in a state of high productivity, it should be kept in grasses and herbaceous vegetation insofar as possible. Maintained in this manner, this area would then exert

Table 5. -- Allegheny Lake Project. Summary of the average annual loss of hunter man-days and associated monetary values predicted by the FWS over the projected 50 year economic life of the project

	White-tailed deer		Wild turkey		Small game		Total	
	No. man-days	Value(\$)	No. man-days	Value(\$)	No. man-days	Value(\$)	No. man-days	Value(\$)
Without-the-project								
New York	509	1,527	180	540	190	190	879	2,257
Pennsylvania	1,930	5,790	1,560	4,680	800	800	4,290	11,270
Total	2,439	7,317	1,740	5,220	990	990	5,169	13,527
With-the-project								
New York	421	1,263	172	516	181	181	774	1,960
Pennsylvania	418	1,254	1,188	3,564	431	431	2,037	5,330
Total	839	2,517	1,360	4,080	612	612	2,811	7,209
Loss								
New York	88	264	8	24	9	9	105	297
Pennsylvania	1,512	4,536	372	1,132	369	369	2,253	6,021
Total amount	1,600	4,800	380	1,140	378	378	2,358	6,318
Percent	66	66	22	22	38	38	46	47

a beneficial influence on forest game species of the surrounding area. In addition, bank fishermen would be able to utilize more fully the reservoir periphery.

It is not thought that loss of hunting opportunities now provided by the 6,534 acres of habitat lost could be prevented entirely. Moreover, due to the nature of the general terrain, it would not be feasible to attempt full compensation for the loss by substitution of other forms of hunting opportunity. However, the loss can be substantially mitigated, and economically so, by providing access into segments of the Allegheny National Forest which are now inaccessible to most hunters. Two large blocks of such inaccessible deer range lie near the project area on the left bank. The locations of these areas, measuring about 3,700 to 6,000 acres in size, are shown in the attached map. [N.B. "attached map" not available] These areas should be made accessible, thereby obtaining a measure of mitigation, and we have been advised by the Corps of Engineers that existing plans for road relocation and new construction will provide the desired access.

Wildlife Resources -- Post-impoundment Occurrences

Lands providing wildlife habitat within the immediate project impact area remaining after impoundment of Allegheny Lake included all lands [3,672 ha (9,073 ac)] between summer-lake conservation pool elevation 404.8 m (1,328 ft) and the top of the maximum flood control pool 416 m (1,365 ft). Approximately 78 percent, 2,858 ha (7,062 ac), of the land area available for wildlife is located in New York with the remainder, 814 ha (2,011 ac), located in Pennsylvania. All but 360 ha (1,327 ac) of project land within the immediate project impact area in New York is located within the Allegany Indian Reservation.

All project lands below the five-year flood frequency pool, plus some additional peripheral lands required to provide public access and for other project purposes, were acquired by the CE in fee with the exception of Allegany Indian Reservation lands in New York. Only flooding easements were obtained for Allegany Indian Reservation lands in New York and for all remaining lands above the five-year flood frequency pool in both Pennsylvania and New York.

Much of the land originally acquired by the CE in Pennsylvania has since been transferred to the U.S. Forest Service (USFS) and incorporated within the Allegheny National Forest. This land transfer was made possible by a formal Memorandum of Understanding (MOU) signed on August 13, 1964 by the Secretary of the Army and the Secretary of Agriculture. The MOU dealt with the planning, development and management of recreation and

other related land management activities associated with the Allegheny Lake project (10). A total of 4,619 ha (11,405 ac) of CE purchased land had been transferred to the USFS prior to 1973 (11).

Land managed by the CE

By 1980, CE land holdings within the immediate project impact area consisted of 1,073 ha (2,651 ac). Only a single 180 ha (246 ac) tract at the Kinsua Dam site is located within Pennsylvania. The remaining land area, 973 ha (2,405 ac), consists of 12 parcels of land ranging from less than 0.5 ha (1 ac) to 259 ha (640 ac) located on the state of New York. Each of the parcels in New York marks a location where the lake level at maximum flood pool extends beyond the borders of the Allegheny Indian Reservation.

For management purposes, the CE has classified these lands as wild areas (73 percent) wildlife management areas (20 percent) or esthetic management areas (7 percent).

On-the-ground management by the CE for wildlife resources has been extremely limited. CE wildlife management efforts have been directed primarily to measures designed to protect lands from over-use and to allow the vegetation cover to seek equilibrium through natural succession. The small size and wide dispersal of the areas discourages their intensive management specifically for hunting. Some effort has been made to enhance populations of non-game wildlife species. For example, approximately 43 blue bird nesting boxes have been installed by the CE at stru-

tegit locations on project lands.

Post-impoundment hunter survey data has not been obtained by the CE, therefore, it is not possible to provide estimates of hunter-use made specifically on the small parcels of CE managed land. However, some indication of post-impoundment impact of the Allegheny Lake project on hunting pressure is available from lands contiguous to the lake in both Pennsylvania and New York.

Lands managed by the USFS (Pennsylvania)

Project lands in Pennsylvania transferred by the CE to the USFS were later consolidated with contiguous Allegheny National Forest lands by the USFS to form a single management unit designated as the Allegheny Reservoir Composite (Figure I). This much larger project impact area consists of a total of 34,274 ha (84,691 ac) and includes 30,735 ha (75,944 ac) of land and 3,540 ha (8,747 ac) of water (Phillip D. Weston, Jr., Wildlife Biologist, USFS, pers. comm., 1981).

Federal agency responsibility for wildlife resource management on the Allegheny River Composite was vested with the Allegheny National Forest. Administration of the wildlife management program conducted on the area by Allegheny National Forest Service personnel was carried out in close cooperation with the Pennsylvania Game Commission (PGC) under terms of a MOU executed by the PGC and the USFS (12).

Wildlife management within the Allegheny River Composite area is fully

integrated with contiguous Allegheny National Forest holdings. Major wildlife management considerations and objectives in effect throughout the entire Allegheny National Forest include the following (13):

1. Project endangered and threatened species.
2. Provide habitat to maintain reasonable population for native game and fish and non-game and fish species for both consumptive and non-consumptive uses.
3. Encourage the Pennsylvania Game Commission to regulate the size of the deer herd to provide a population compatible with the desired habitat conditions, maintain animal quality, and minimize conflict with other resource management.
4. Provide, in cooperation with state agencies, areas suitable to the varying needs, interests, and skills of the public--the intent being to retain some areas for quality of experience rather than solely for numbers of participants.
5. Use appropriate timber management activities to enhance wildlife habitat conditions.
6. In regenerating stands of timber, maximize the edge effort.
7. Extended rotations will be planned for 10% of the forested areas. Mass producing stands will have first priority for rotation extension.
8. Coniferous and broadleaf evergreen cover should be provided on up to 10% of the forested area of the forest.
9. No more than 20% of a compartment area should receive a regeneration cut during a cutting cycle of 10 years.
10. A range of from 1 to 5% of the land in each compartment should be established in one-to-five acre openings near springs, seeps, streams, or other sources of water.

The most abundant wildlife species present within the Allegheny Reservoir Composite are the white-tailed deer, bear, turkey and squirrel. Other species present are ruffed grouse, snowshoe hare, cottontail rabbit, fox, raccoon, wood cock and wood duck. Two blue heron rookeries,

averaging approximately 20 ha (50 ac) each, are located on the area. Migrating waterfowl also use Allegheny Lake for resting. Sightings of the bald eagle have been reported occasionally, but no nesting on the area has been documented.

Estimates of hunting pressure have been made annually by the USFS from 1970 through 1979. These estimates were obtained in conjunction with overall recreational use statistics collected and published as computer printouts under the Forest Service Information Management (RIM) program.

Under this system, the use data is reported as the number of visitor days expended for any given recreational activity. A "visitor day," as defined by the USFS represents a 12-hour period, and thus, may include more than a single recreational occasion or trip.

In order to provide data comparable to that provided by the FWS pre-impoundment reports, the number of hunting visitor days reported in the RIM printout were converted to man-days based on the average number of hours actually spent in the field by hunters on any single occasion.

Based on information provided by Allegheny National Forest personnel, a big game hunting trip averaged 6.9 hours, small game hunting trip, 4.4 hours and a waterfowl hunting trip, 4.0 hours.

A summary of hunting man-days use extracted from the RIM computer printouts from 1970 through 1979 is presented in Table 6.

Based on the RIM computer printout data, an average of 161,200 post-

Table 6. -- Allegheny Lake Project. Estimates of annual hunting pressure (expressed in thousands of days) recorded for the approximately 30,757 ha (76,000 ac) of land within the Allegheny Reservoir Recreation Area managed by the U.S. Forest Service. Data concerning visitor-day use (12 hours/day) derived from annual RIM estimates compiled by the U.S. Forest Service

Year	Big game		Small game		Total		Waterfowl		Grand total	
	No. visitor days	No. man-days	No. visitor days	No. man-days	No. visitor days	No. man-days	No. visitor days	No. man-days	No. visitor days	No. man-days
1970	2.8	4.9	4.1	11.2	6.9	16.1	3.4	10.2	10.3	26.3
1971	3.1	5.4	4.2	11.7	7.4	17.1	3.3	9.9	10.7	27.0
1972	3.5	6.1	4.9	13.4	8.4	19.5	0.5	1.5	8.9	21.0
1973	5.0	8.7	5.7	15.6	10.7	24.3	0.3	0.9	11.0	25.2
1974	12.9	22.4	6.9	18.8	19.8	21.0	1.2	3.6	41.2	44.8
1975	12.9	22.3	13.2	35.9	26.1	58.3	1.3	3.9	27.4	62.2
1976	81.5	141.8	77.9	212.7	159.4	354.5	1.5	4.5	160.9	359
1977	81.5	141.8	77.9	212.7	159.4	354.5	1.5	4.5	160.9	359
1978	85.3	148.4	78.7	214.9	164	363.3	1.5	4.5	165.5	367.8
1979	85.3	148.4	78.7	214.9	164	363.3	1.5	4.5	165.5	367.8

* No. man-days derived by multiplying number of visitor days by following conversion factors supplied by the U.S. Forest Service: big game, 1.74; small game, 2.73; waterfowl, 3.0

impoundment hunting man-days for big game and small game species were estimated annually from 1970 through 1979 on the 30,757 ha (76,000 ac) of land within the Allegheny Reservoir Composite area managed by USFS. The lowest annual hunting pressure was recorded in 1970 (16,100 man-days) and the highest in 1979 (363,300 man-days). This level of hunting pressure is equivalent to an average annual hunting pressure of 5.2 man-days/ha (2.12/ac) and ranged from a low of 0.5 man-days/ha (0.2/ac) in 1971 to a high of 11.9 man-days/ha (4.8/ac) in 1979.

Analysis of PGC collected hunting effort survey data pertinent to the two Pennsylvania counties in which the project is located (McKean and Warren counties) suggested that hunting pressure on the project area, although substantial, was probably much lower than indicated by the USFS RIM computer printouts. These PGC surveys were conducted during the mid-1970's in each county in Pennsylvania. Hunting intensity on the Allegheny Lake project impact lands were considered to be comparable with values obtained from the county-wide survey data collected by the PGC (William Shope, Wildlife Biologist, PGC, pers. comm., 1981).

Based on hunting intensity and land area relationships as presented in Table 7, the project impact area supported an estimated 26,745 hunter man-days/year during post-impoundment years. This level of hunting effort is equivalent to 0.87 man-days/ha/year (0.35/ac/year) as compared to the 5.2 man-days/ha/year (2.12/ac/year) estimate derived from the USFS RIM data.

Table 7. -- Allegheny Lake Project. Estimates of average annual post-impoundment hunter man-days use on the 30,757 ha (76,000 ac) project impact area located in Pennsylvania (McKean and Warren counties) as derived from county hunter survey data collected by the PGC in the mid-1970's. (USFS RIM estimates of hunter man-day use in parenthesis)

		McKean county	Warren county	Total project area
<u>Area</u>				
No. ha		26,306	4,451	30,757
No. ac		65,000	11,000	76,000
No hunters ^{1/}		2,844	722	3,566
No. man-days ^{2/}		21,330	5,415	26,745 (161,200)
No./ha		0.81	1.2	0.87 (5.24)
No./ac		0.33	0.49	0.35 (2.12)

^{1/} Reflects PGC survey estimates of 10.8 hunters/sq kl (28/sq mi) in McKean county and 16.2 hunters/sq kl (42/sq mi) in Warren county.

^{2/} Completed by multiplying the number of hunters by 7.5 (statewide average number of man-days hunted per individual hunter per year).

Lands Managed by the Seneca Nation of Indians (New York)

Lands suitable for wildlife within the project impact area in New York are situated almost entirely within the Allegany Indian Reservation which is administered by the Seneca Nation of Indians. The Seneca Nation of Indians exercises complete autonomy over hunting, fishing and other wildlife-oriented activities on reservation lands and that portion of Allegheny Lake contiguous to the reservation. The area of project within the Allegany Indian Reservation impact comprises some 2,298 ha (5,678 ac).

Management of wildlife populations and/or wildlife habitat on reservation lands has been minimal since impoundment of Allegheny Lake. The primary management thrust has been directed to improving lake access, boating and camping facilities, and related recreational amenities.

Special licenses must be obtained from the Seneca Nation of Indians to hunt or fish on Allegany Indian Reservation lands and waters. Free licenses are available to reservation residents and other members of the Seneca Nation of Indians. Non-Indians must purchase licenses from the Seneca Nation of Indians to hunt or fish. Authorization for licensing non-members of the Nation was provided by the U.S. Congress in the Act of August 31, 1964 (78 stat. 738).

Unfortunately, records of the number of licenses issued in post-impoundment years are available only sporadically for a few years (1973-1980). A tabulation of the available license sale data, obtained from the

Clerks Office of the Seneca Nation of Indians, is presented in Table 8.

During the last two years, license data was available (1978-79 and 1979-80), an average of 223 hunting licenses were sold to non-Indians and 180 free hunting licenses were issued to residents of the Allegany Indian Reservation. An additional of 112 combination hunting and fishing licenses were issued to residents of the Allegany Indian Reservation in 1979-1980.

Due to a lack of pertinent annual hunting frequency data, it is difficult to provide a firm estimate of hunter man-day use on the Allegany Indian Reservation. However, assuming a minimum estimated value of 7.5 hunting man-days per year per licensed hunter, the 223 non-Indian license holders would have spent an average of 1,673 hunting man-days per year on reservation lands and the 180 Indian license holders would have spent an estimated 1,350 man-days for a total hunting effort of approximately 3,000 man-days per year on project impact lands.

This minimum estimate of 3,000 man-days per year ignores additional hunting effort which was undoubtedly exerted by the individuals who obtained a combination hunting/fishing license, as well as any hunting effort exerted by unlicensed individuals. On an area basis, the estimated hunting effort on Allegany Indian Reservation lands within the project impact area amounts to a minimum of 1.3 hunting man-days/ha (0.53/ac).

Table 8. -- Allegheny Lake Project. Summary of hunting and fishing licenses issued by the Seneca Nation of Indians in post-impoundment years

Year	Non-Indian		Reservation Residents			Total
	Hunting license	Fishing license	Comb. license	Hunting/ fishing license	Fishing license	
1974-75						
1976-77	46	1,546				
1977-78	-	-	1,855			
1978-79	220	5,500				
1979-80	225	7,575				
			275	79	-	354
			293	149	-	442
			1,225	110	106	341
			1,777	211	-	308
			1,882	122	112	416

Wildlife Resources -- Discussion of Planning Input

Wildlife resources planning for the Allegheny project was complicated by the involvement of an unusually large number of political entities and agencies with diverse and often conflicting statutory prerogatives and program objectives. The principal agencies within the Federal Government included the FWS, USFS, the CE and the Bureau of Indian Affairs. State agencies included the New York Department of Conservation (NYDC), the Allegany State Parks and Recreation Commission (New York), the Pennsylvania Game Commission and the Pennsylvania Fish Commission. The Seneca Nation of Indians also was involved as almost all of the project impact area in New York was located within the Allegany Indian Reservation or on lands owned by members of the Seneca Nation of Indians. County governmental agencies in two counties in Pennsylvania (McKean and Warren counties) and Cattaraugus county in New York were marginally involved.

The National Park Service (NPS) was involved briefly with the planning process in conjunction with a proposal that the project impact area be administered by the NPS as a National Recreation Area (14). This proposal was later withdrawn because of the opposition of the Seneca Nation of Indians and the State of New York.

As the principal landowner immediately adjacent to the project in Pennsylvania the USFS became intimately involved with wildlife resources planning for the project, viz (15):

The Forest Service recognizes that the Fish and Wildlife Service recommends a General Plan for fish and wildlife developments only when specified lands will be owned and managed primarily for wildlife by either the Fish and Wildlife Service or the affected State game agency. Because any national forest lands to be dedicated primarily to wildlife will be administered by the Forest Service under a cooperative agreement with the Pennsylvania Game Commission or Pennsylvania Fish Commission, the Forest Service is not expected to be a co-signer of the General Plan. However, because the administration and management of lands under the Plan may affect decisions on management of certain national forest lands, the Forest Service requests that it be consulted at the time the General Plan is developed.

As the lead agency for wildlife resources planning for the Allegheny project, the FWS was responsible for the coordination of multi-agency planning efforts and for the submission of project planning reports to the CE. FWS planning activities were initiated early in calendar year 1956, with a series of introductory conferences held with the NYDC, FGC, USFS, and the CE. Appropriate field investigations were undertaken in co-operation with the affected agencies which provided an evaluation of wildlife habitat and populations and estimates of hunting use on project affected lands (16).

Data acquired during this field investigation stage subsequently were incorporated by the FWS in a draft project report dated August, 1958, which was submitted to the CE September 10, 1958 (5). This FWS report contained a comprehensive appraisal of pre-impoundment wildlife resources available within the project impact area including a description of habitat, wildlife population densities and hunting pressure.

The report predicted that a substantial reduction of wildlife populations and associated hunting use would occur within the project impact area as a result of habitat loss and degradation associated with the impoundment of Allegheny Lake. No numerical estimates of post-impoundment hunter man-days loss and/or associated monetary values were included in the August, 1958, FWS report.

The August, 1958 FWS report emphasized that in-kind replacement of the predicted post-project losses of wildlife populations and associated recreation use was not possible. However, the report contained recommendations which appeared to be appropriate for achieving at least partial mitigation of project occasioned wildlife resource losses.

For example, one such recommendation stipulated that the CE acquire and develop nine sub-impoundments within the project impact area. These areas comprised a total of approximately 810 ha (2,000 ac) including 397 ha (981 ac) of water surface and 413 ha (1,021 ac) of surrounding land. Another recommendation required that all existing gas and oil wells within the project sites be sealed. The report also recommended that incidentally acquired project lands suitable for wildlife be opened for public hunting and that the state fish and game agencies of New York and Pennsylvania be authorized to administer these lands for fish and wildlife management purposes.

There was an extended delay between the submission of the initial FWS draft report on September 10, 1958, and the submission of the final FWS

report to the CE in May 9, 1961. Several significant events occurred during this interim period which contributed to the delay. Litigation was in process the latter part of 1958 through mid 1959 which prevented the CE from undertaking any activities connected with planning or construction of the project. The refusal of the Supreme Court on July 26, 1959, to review a lower court decision upholding the Governments right to flood lands owned by the Seneca Nation of Indians permitted a resumption of the project related activities by the CE.

Additional delays were engendered by the NYDC discovery that development of the sub-impoundments as recommended in the August, 1958 FWS report was not feasible because of unfavorable composition of soils underlying the proposed sub-impoundment sites.

A conference, attended by the principal state and federal agencies associated with the Allegheny project, was convened by the FWS June 7, 1960, in Warren, Pennsylvania. Each agency presented a list of recommendations concerning wildlife resources as follows (17):

A. Forest Service:

1. That project authorization be amended to allow purchase of lands and authorized expenditure of funds for other measures to preserve or develop fish and wildlife resources and recreational opportunities based thereon.
2. That private lands in warrant 3,711 and lots 66 and 96 be acquired to prevent loss of wildlife production due to inundation of other habitat. The extent to which acquisition and development of these 532 acres would mitigate loss of other habitat has not been determined. Estimated pro-

ject costs for this measure amount to \$52,000 for acquisition and \$20,000 for initial development.

3. That 50 well-distributed one-acre openings on Forest Service land and 50 one-acre evergreen plantings should be established to further mitigate loss of production due to loss of habitat inundated. Extent of mitigation to be achieved by this measure at an initial cost of \$12,500 has not been determined.
4. That new roads be properly located and constructed with turn-outs every 600 feet to prevent loss of hunter-recreation opportunity due to destruction of existing access facilities. This is also a tool for proper management of big game, as is the present road system. The extent to which loss of hunting opportunity and big game management facilities would be mitigated by the measures proposed has not been determined.

B. New York Conservation Department:

1. Prevention of loss of wildlife production and hunting opportunities will need to be accomplished through mitigation measures applied outside the project area but within the watershed. This is because the Indian Nation controls reservoir lands in that portion within New York state. Also, all sites at which sub-impoundments for public fishing areas and wildlife marshes might have been developed within the reservoir limits were investigated and proved to be unfeasible because of underlying porous gravel deposits which would make development costs prohibitive. Wildlife losses will largely be those associated with upland game. The amount of loss has not been evaluated. The Quaker Run development, in which the Parks Division is interested, may increase wildlife losses.
2. The State desires to develop and improve habitat for upland game and waterfowl in areas outside project limits to mitigate or compensate for upland game losses. Indian lands are presently open to hunting, and although a fee is charged,

it is not such as to deter anyone from hunting there who wishes to. It would appear reasonable to evaluate use of these lands as a part of the existing game habitat and hunting opportunity which will be lost through inundation.

C. The Pennsylvania Game Commission:

1. The measures proposed by the U.S. Forest Service, generally speaking will be adequate to prevent loss and promote development of wildlife, although the recommended amount of land to be acquired (532 acres) should be increased to 1,000 or even 1,500 acres. They have not evaluated the magnitude of losses nor the amount of mitigation which the proposed measures would accomplish.

A draft report on the fish and wildlife resources of the Allegheny project was circulated to appropriate agencies by the FWS on April 10, 1961. This draft FWS report contained nine specific recommendations, two of which were directly pertinent to wildlife resources. These two recommendations included requests for land acquisition to mitigate predicted wildlife habitat loss due to impoundment and for the construction of roads within the project impact area to improve hunter access.

After receipt of comments, the final FWS report was submitted to the CE the following month (May 9, 1961). This final FWS report consisted of a brief 5-page letter report signed by the Director of the FWS along with a more detailed substantiating report (6, 7).

The May 9, 1961 FWS final report concluded that the significant loss of hunting opportunity predicted as a result of project development would be offset by improved hunter access expected as a result of the CE's

road relocation plans and by future USFS road construction on Allegheny National forest lands. Also, the final FWS report concluded that partial mitigation of wildlife habitat losses expected as a result of impoundment could be accommodated by allowing state fish and wildlife agencies to manage incidentally acquired project lands in lieu of purchasing specific wildlife mitigation lands as recommended in the earlier April 10, 1961 draft report.

Only two formal recommendation concerning wildlife resources were submitted in the May 9, 1961 FWS final report. These recommendations were general in nature and did not provide adequate guidance as to specific measure appropriate for the protection and/or mitigation of anticipated wildlife resource losses, viz:

1. That all agencies whose responsibilities for resource management relate them to the Allegheny River Reservoir project, including the New York Department of Conservation, Pennsylvania Game Commission, Pennsylvania Fish Commission, U.S. Forest Service, National Park Service, Seneca Indian Nation, this Bureau, and any other appropriate agencies or groups, meet to consider at the proper time a formulation of a reservoir land use plan under the coordinating leadership of the Corps of Engineers which will include, among other things; reservoir zoning for fishing, boating, and other uses; management of peripheral reservoir lands, development of adequate sites for fishing use in New York and Pennsylvania, supplementing those now planned by the Corps; stream temperatures to be maintained in river at the dam; additional public access to Allegheny River on right bank between Kinzua Dam and Tidioute; extended fishing seasons; reciprocal fishing license agreements; location and adequacy of access areas; and mitigation of habitat losses due to inundation.
2. That reasonable additional modifications compatible

with primary purposes of the project be made in project facilities or operations, subsequent to completion of construction, as may be desirable to obtain maximum over all project benefits, on the basis of follow-up studies by this Bureau to improve or supplement measures taken for the conservation and development of fish and wildlife resources.

The specific recommendation contained in the April 10, 1961 draft report which called for land acquisition to provide for habitat mitigation and for road construction to improve hunter access within the project impact area were omitted in the final May 9, 1961 FWS report.

It was apparent from a review of available correspondence commenting on the draft of April 10, 1961 FWS draft report that the FWS capitulated to CE objections to inclusion of specific recommendations for purchase of mitigation lands. The CE objection to the April 10, 1961 FWS draft report recommendation for land acquisition was displayed in an April 21, 1961 Memorandum from the District Engineers addressed to the Chief, Division of Technical Services, Fish and Wildlife Services, viz (18):

- (1) As indicated in Comment on recommendations 2, 4, 5, 6, 7 and 8 data furnished in your report, presently planned project features provide an adequate replacement for the existing fish and wildlife resource as well as substantial improvements in some aspects of the resource. Under these circumstances additional Congressional authorization would be necessary to develop additional resource potential for the project.

Apparently, accepting this CE conclusion at face value, the FWS subsequently omitted any specific recommendation for land acquisition in the final May 9, 1961 FWS report. The rationalization offered by the FWS

for deleting the specific recommendations for land acquisition and development was presented in a May 12, 1961 Memorandum from the Chief, Division of Technical Service to the Director, Bureau of Sport Fisheries and Wildlife, as follows (19):

After receiving all comments, our conclusions were such that all recommendations involving expenditure of funds were withdrawn; it did not seem necessary, therefore, to have Congress consider amending the authorization to include fish and wildlife conservation and development as a project purpose... Since wildlife habitat losses are fairly small and the Corps insists it would need to hold public hearings and get Congressional authorization to acquire added lands, even for mitigation, we have deleted this recommendation and have included the subject of mitigating habitat losses in recommendation number 1 of the final draft.

Abandonment of the April 10, 1961 FWS draft report recommendation for road construction to improve hunter access within the project impact was rationalized in this same May 12, 1961 Memorandum, as follows:

Recommendation for access roads to provide partial mitigation for loss of hunting opportunities has been deleted on the assurance of the Corps that such access has already been provided as a part of their road relocation plan.

Accuracy of Prediction

The Allegheny project impact area, as defined in the May 9, 1961 FWS final report, consisted of all lands and water below the designed maximum flood pool elevation 416 m (1,365 ft). Without the project, the impact area included 7,905 ha (19,533 ac) of land. With the project in place, terrestrial habitat within the immediate project impact area would be reduced by some 54 percent only 3,672 ha (9,073 ac). Hunting

effort was expected to be reduced by 46 percent (from 5,169 man-days per year without the project to 2,811 man-days per year with the project in place).

The most severe reduction in hunting effort within the immediate project impact area was expected to occur in the Pennsylvania portion (from 4,290 man-days per year without the project to 2,253 man-days per year with the project in place). Hunting man-day effort for white-tailed deer in the Pennsylvania sector of the impact area was expected to experience the most severe decline (78 percent as compared to 24 percent for wild turkey and 46 percent for small game).

However, the FWS predicted that the additional hunting effort expected from improved hunter access planned for contiguous areas of the Allegheny National Forest in Pennsylvania would fully compensate the loss of hunter man-days incurred in the immediate project impact area. An analysis of available post-project hunter use data tended to verify the validity of this FWS prediction. For example, the number of hunting licenses sold in the two counties bordering the project (McKean and Warren counties) in post-project years averaged some 20 percent higher than in pre-project years. This increase in hunting license sale was accomplished in spite of an overall human population decline in the two counties during post-project years (Table 9).

Further indications of increased post-impoundment hunting pressure was indicated by the 82 percent increase in total white-tailed deer harvest

Table 9. -- Allegheny Lake Project. Pre-and post-impoundment comparison of resident annual hunting license sale (average number per year) and population trends in McKean and Warren counties, Pennsylvania with statewide trends. Human population and number of licenses sold presented in thousands for statewide data. (Actual numbers for county data.)

	McKean co.	Warren co.	Total	Statewide
<u>Average annual population*</u>				
1960-1965	53,867	46,107	99,974	11,438
1966-1979	51,710	46,927	98,637	11,746
Percent change	-4.0	+1.8	-1.3	+2.7
<u>Resident hunting license sale</u>				
1960-1965	9,089	7,043	16,132	899.7
1966-1979	10,134	9,298	19,432	1,101.1
Percent change	+11.5	+32.0	+20.5	+22.4
<u>No. licenses/100 population</u>				
1960-1965	16.9	15.3	16.1	7.9
1966-1979	19.6	19.8	19.7	9.4
Percent change	+16.0	+29.4	+22.4	+19.0

* Calculated from U.S. Bureau of Census statistics

(67 percent for antlered deer) recorded by the PGC during post-project years (Table 10). The total number of white-tailed deer harvested per license also increased by some 48 percent (33 percent for antlered deer) in post-impoundment years, suggesting that the increase noted in deer harvest might possibly be attributed to an increase in deer density and/or improved hunter access as well as to an increase in overall hunting effort.

A significant amount of the post-project increase in hunting effort recorded by the PGC for the two county area in Pennsylvania undoubtedly occurred within the Allegheny National Forest in close proximity to the project. This portion of the Allegheny Forest contains excellent wildlife habitat, particularly for white-tailed deer.

A more modest decline (12 percent) in post-project hunting effort was predicted by the FWS for the New York portion of the project impact area, along with a 33 percent reduction in habitat. Hunting effort in New York was predicted to decline from an average of 879 hunter man-days per year without the project to 774 man-days per year with the project in place. This prediction was not supported by post-impoundment observations. Based on the number of hunting licenses issued by the Seneca Nation of Indian, and with the assumption that each license holder hunted 7.5 times/year, estimated post-project hunter man-day use within the New York sector of the project impact area was substantially higher than predicted in the May 9, 1961 FWS final report. The average annual post-project hunting effort estimate of 3,000 hunter man-days per year

Table 10. -- Allegheny Lake Project. Comparison of average annual pre-impoundment (1960-1965) and post-impoundment (1966-1979) license sale and legal deer harvest in McKean and Warren counties, Pennsylvania. (County-wide deer harvest and license sale data provided by the POC)

	License sale (number)	No. deer harvested		No. deer/license	
		Antlered	Antlerless	Antlered	Antlerless
<u>McKean</u>					
Pre-impoundment	9,089	1,204	894	0.13	0.10
Post-impoundment	10,134	1,970	1,981	0.19	0.20
Percent change	+8.5	+64	+122	+32	+100
					+70
<u>Warren</u>					
Pre-impoundment	7,043	1,179	1,013	0.16	0.14
Post-impoundment	9,298	2,010	1,864	0.22	0.20
Percent change	+32	+70	+84	+38	+43
					+35
<u>Total</u>					
Pre-impoundment	16,132	2,383	1,907	0.15	0.12
Post-impoundment	19,432	3,980	3,845	0.20	0.20
Percent change	+20	+67	+102	+33	+66
					+48

(including 1,350 man-days per year by Indians and 1,673 man-days per year by non-Indians) was almost four times greater than the 774 man-days per year predicted by the FWS. Considering only non-Indian hunting participation, post-project hunting effort was more than twice as great as predicted.

In fact, the estimated post-project hunting effort expended in the New York sector alone (3,000 man-days/year) was greater than the 2,811 man-days/year predicted by the FWS for the entire project impact area in both New York and Pennsylvania.

It is noteworthy that the substantially lower hunting effort assessed by the FWS for the New York segment [amounting to only 0.2 man-days/ha (0.08/ac) as compared to 1.2 man-days/ha (0.47/ac) for the Pennsylvania sector of the project impact area] reflected the questionable omission of the hunting effort exercised by residents of the Allegany Indian Reservation. This narrow FWS interpretation of wildlife planning report objectives, i.e. restriction only to recreational hunting aspects -- appears to be completely inappropriate for satisfaction of fish and wildlife resource planning responsibilities pertinent to water resource development projects.

FISHERY RESULTS AND DISCUSSION

Fishery Resources -- Pre-impoundment Predictions (without-the-project)

Fishery resource related aspects of the Allegheny Lake project were initially described in the August, 1958 FWS report (5). Information presented in this detailed August, 1958 FWS report was used extensively in the subsequent May 9, 1961 FWS final letter report (6) and May 9, 1961 FWS substantial report (7).

Pre-impoundment stream fishery resources in the general area of the Allegheny Lake project were characterized as significant in all reports. The Allegheny River, in particular, supported an excellent recreational fishery for smallmouth bass and other highly prized warm water species (7),

viz:

The Allegheny River possesses a highly significant warm water fishery from Kittanning, about 35 miles northeast of Pittsburgh, to near the headwaters. Many leading fishery biologists consider parts of this river to be the best smallmouth bass stream in the northeast. Because of its comparative remoteness and scenic beauty, the upper reaches of the river attract thousands of fishermen. Numerous cabins and summer cottages have been constructed near the water's edge expressly for fishing purposes. Fishing enthusiasts float segments of the river by boat and canoe to reach favorite or otherwise inaccessible areas. Of local importance is the business of selling bait or renting boats and cabins to visiting fishermen.

Allegheny River is principally a smallmouth bass stream. However, other species such as muskellunge, walleyes, rock bass, yellow perch, carp and suckers contribute to the catch. Each year some trout, primarily brown and rainbow, are also taken. Fishing commences in early spring and extends into late fall. Fall fishing is especially popular and some of the season's best catches are made at that time of year.

The fish population in the Allegheny River between Warren, Pennsylvania and the proposed Kinzua Dam site was sampled periodically from September, 1958 through August, 1960 by seining, rotenone sampling and electro-fishing. Some 47 species of fish representing 10 families were collected during the survey (20). Minnows (14 species excluding carp) and darters (10 species) were the most abundant fishes collected during the survey. Of the fish species commonly creeled by recreational fishermen, the smallmouth bass was by far the most abundant species; followed in descending order of abundance by: suckers (six species) pumpkinseed sunfish, rock bass, yellow bullhead, brown bullhead, yellow perch, walleye, muskellunge, carp, largemouth bass, bluegill and brown trout.

Several tributary streams of the Allegheny River located in both New York and Pennsylvania supported a recreational trout fishery (7), viz:

Many of the streams tributary to the Allegheny River within the project area are considered trout waters. Of significance are Kinzua Creek, Sugar Run, and Willow Creek in Pennsylvania, and Quaker Run and Red House Brook in New York. Rainbow trout from the river are said to spawn in Quaker Run. Smaller tributaries such as Wolf, Bone, Sawmill, and State Line Runs in New York and Cornplanter Run in Pennsylvania are considered to be fair to good trout streams, but are lightly fished. Trout fishing in all the streams named is maintained primarily through annual stocking by the New York Department of Conservation, the Pennsylvania Fish Commission, and on the Allegheny National Forest by the Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, in cooperation with the Pennsylvania Fish Commission.

Angling within the Allegany Indian Reservation located in the New York

Sector of the project, was subject to special regulation (5), viz:

Angling in the New York section of the site is somewhat influenced by the presence of the Allegheny Indian Reservation...Non-Indian anglers who wish to fish within the Reservation are required to purchase a special license. For this reason angling pressure by the general public on the reservation is probably less than otherwise would be expected.

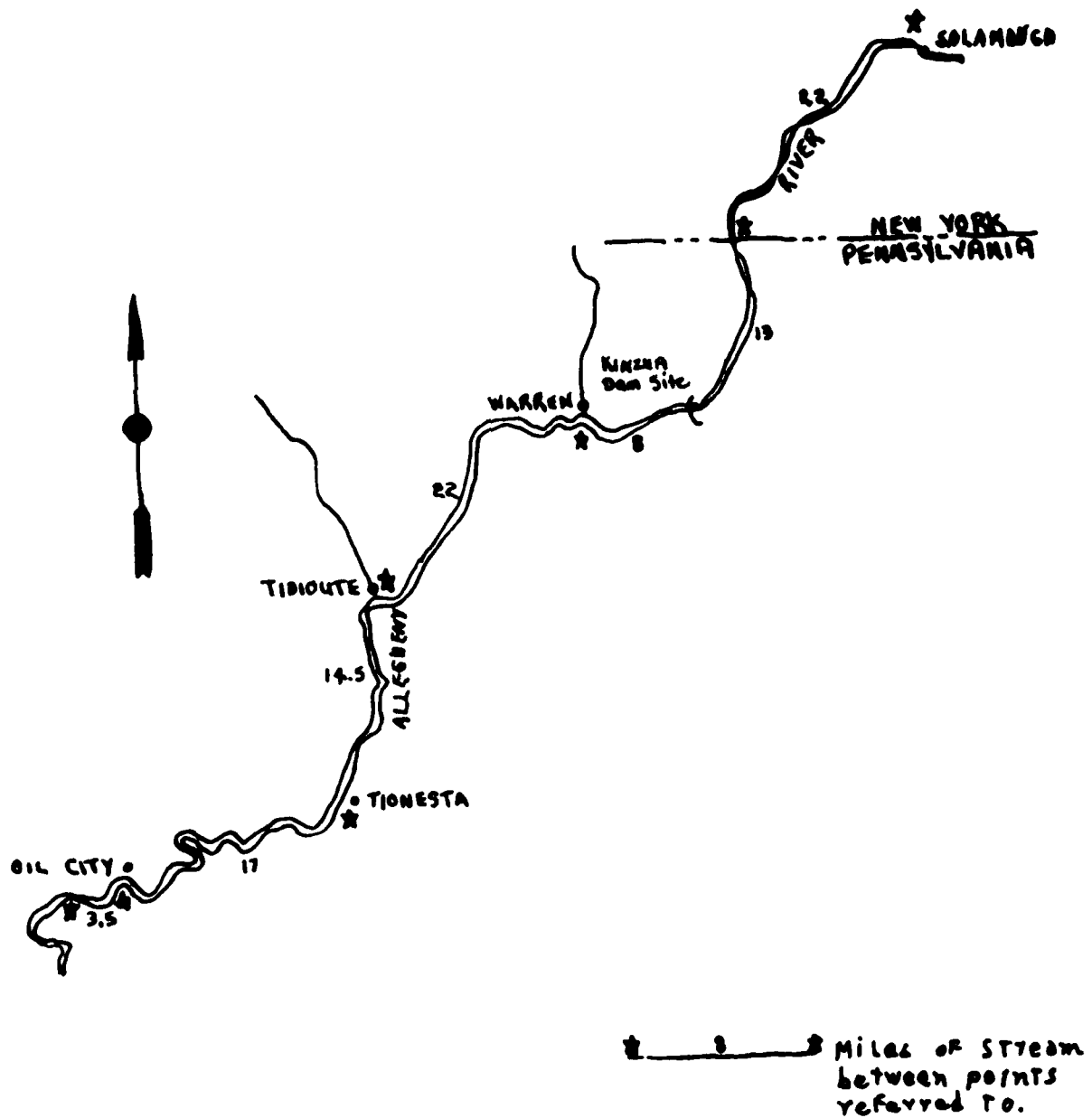
As delineated by the authors of the May 9, 1961 FWS final report, the project impact area encompassed a total of 161 km (100 mi) of the Allegheny River extending downstream from Salamanca, New York to the vicinity of Oil City, Pennsylvania plus approximately 43 km (26 mi) of tributary trout streams located within the maximum flood control pool [elevation 416 m (1,365 ft)] of the proposed Allegheny Lake.

Approximately 56 km (35 mi) of the Allegheny River was located upstream from the Kinzua Dam site within the designated maximum flood control pool of the proposed Allegheny Lake project. Fishery resources were expected to be affected over an additional 105 km (65 mi) of the Allegheny River below the dam as a result of alteration of stream flow and temperature regimes associated with project operation (Figure 2).

Creel surveys were conducted on the Allegheny River project impact area by the FWS in 1956 and 1957 (5), viz:

In 1956 and 1957 censuses were made of fishermen on the reaches of the Allegheny River which will be affected by the project. Data were obtained by interviewing fishermen on the river and by counting fishermen from an airplane. The primary purpose of the census was to estimate the degree of utilization by fishermen. Additional, but incomplete, data were

Figure 2. -- Length of Allegheny River segments located with the Allegheny Lake project impact zone



obtained on the numbers and species of fish caught by fishermen. The 1956 census started on July 1, the opening day for bass in Pennsylvania, and continued to October 7. In 1957 the opening day for bass was moved up to June 15. Therefore, the census started on that day and continued to September 15. The 1956 census area included the reach between the Glade Bridge, Warren, Pennsylvania and Salamanca, New York. Since returns were relatively few in the New York section, only the Pennsylvania section was censused in 1957. Airplane counts of fishermen between Glade Bridge and a point about 20 miles downstream were also made in 1957.

Fishing pressure on the Allegheny is apparently affected to some extent by the volume of flow of the river. The summer of 1956 was marked by frequent rains which kept the river high and somewhat turbid much of the time. Because of decreased precipitation, the river was low and clear during most of the summer of 1957... Results of the censuses and observations by the interviewers demonstrate that fishing pressure was less in 1956 than in 1957.

Direct results of the census were expanded to include non-interview days and the period between the last interview day and November 15.

Information collected during the 1956 and 1957 creel surveys was subsequently used by the authors of the May 9, 1961 FWS report to develop estimates of without-the-project angler use in the project impact area (7), viz:

Results of the fishing-use survey conducted by the Bureau in 1956 and 1957 show that the project segment of the Allegheny River attracts fishermen from a wide area, including such population centers as Pittsburg, Buffalo, Erie, and Johnstown. As might be expected, the great majority of fishermen who use these waters originate from the area in Pennsylvania where acid mine water pollution is most prevalent. Approximately 175,000 licensed fishermen reside in the area from which most of the present use is derived. Based on current trends it is

estimated that an average of 190,000 fishermen will reside in this area over the next 50 years period.

Data from the 1956-57 survey show that fisherman use of the river is not uniform. Three distinct use patterns occur in the 70-mile reach of river from Salamanca, New York downstream to Tidioute, Pennsylvania. From Salamanca to the New York-Pennsylvania State line, the segment encompassed by the Allegheny Indian Reservation, the river receives about 110 man-days of fisherman use per mile per year. From the State line downstream to Warren, Pennsylvania, the river supports annually about 750 man-days of fisherman use per mile. In the 30 mile reach downstream from Warren, the annual fisherman use per mile is about 1,840 man-days. Projected over a 50-year period in the immediate future, fisherman use of the river without-the-project will average about 10 percent higher than present, i.e., average annual fisherman use of the 3 stream segments just described will be 120,825 and 2,025 man-days per mile, respectively. While the segment of river between Tidioute and Oil City, Pennsylvania was not included in the 1956-57 fisherman-use survey, all available data indicate that this area will receive about the same degree of use as the reach immediately upstream, or about 2,025 man-days per mile per year.

The May 9, 1961 FWS final report also provided an estimate of the monetary values of the recreational fishery in the various segments of the Allegheny River within the Allegheny Lake project impact area, as follows:

Based on schedule of values for recreational aspects of fish and wildlife adopted by the Inter-Agency Committee on Water Resources, a day fishing small-mouth bass on a top quality stream such as the Allegheny River is valued at \$3.00. At this rate, projected use without-the-project from Salamanca to Kinzua Dam site will be worth \$39,900 annually, and that from the dam site to the vicinity of Oil City, \$366,300--a total average annual value of \$406,200.

Without-the-project estimates of fishing man-day use and monetary values

for various sections of the Allegheny River fishery within the project impact zone are presented in Table 11.

Estimates of angling use of the tributary trout waters located within the project impact area in New York and Pennsylvania were also made (op. cit.), viz:

Early in the trout season, fisherman use of the tributary streams is high. However, during the summer and fall when stream flows are low and fisherman are attracted to the river and other fishing sites, the trout streams are only lightly utilized. Recent surveys have shown that Kinzua Creek presently receives about 500 man-days of fisherman use per mile per year. The lower reaches of Quaker Run and Red House Brook each receives about 100 man-days of use annually per mile.

The May 9, 1961 FWS report failed to provide without-the-project estimates of the total monetary value of the trout fishery supported by tributary streams. Only estimated monetary values per mile of stream were listed, as follows:

Based on the rates for evaluation of recreational fishing on cold water streams, use of Kinzua Creek is valued at approximately \$1,000.00 per mile per year, Sugar Run at about \$75.00, Willow Creek at about \$25.00, while use of the 2 streams of significance in the New York sector, Quaker Run and Red House Brook, is valued at \$250.00 per mile each per annum.

Since trout fishing is becoming increasingly popular, fisherman use of all trout streams will increase during the project life. Improvement in strains of hatchery reared trout and in stream habitat conditions should provide the basis whereby tributary streams will support about twice the number of fisherman presently using these resources, thus reflecting a comparable increase in sport fishing value.

Table 11 -- Allegheny Lake Project. Summary of without-the-project estimates, over assumed 50 year economic life of project, of annual fishing man-day use and monetary values of the recreational fishery supported by the Allegheny River within the project impact area

River segment	Stream length		No. man-days/km		No. man-days/yr		Total*	Monetary value**
	No. km	No. mi	No. man-days/km	No. man-days/yr	No. man-days/yr	No. man-days/mi		
Salamanca, NY to NY-PA state line	35	22	74	120			2,600	7,800
NY-PA state line to Kinzua Dam site	21	13	510	825			10,700	32,100
Subtotal above dam	56	35	234	374			13,100	39,900
Kinzua Dam site to Warren, PA	13	8	510	825			6,600	19,800
Warren, PA to Tidioute, PA	35	22	1,275	2,025			44,600	133,800
Tidioute, PA to Tionesta, PA	23	14.5	1,275	2,025			29,400	88,200
Tionesta, PA to Oil City, PA	33	20.5	1,275	2,025			41,500	124,500
Subtotal below dam	105	65	1,165	1,882			122,300	366,300
Total	161	100	841	1,354			135,400	406,200

* Rounded

** Value at \$3.00/man-day

With-the-project

Both the August, 1958 FWS report and the May 9, 1961 FWS report predicted that construction of the Allegheny Lake project would profoundly affect the existing recreational fishery within the project impact zone which extends approximately 161 km (100 mi) below Salamanca, New York to the vicinity of Oil City, Pennsylvania.

August, 1958 FWS Report

The August, 1958 FWS report did not quantify the extent of the impact expected from project construction on fishing man-day use and/or monetary value of the recreational fishery. However, the report provided a qualitative assessment, viz:

Construction of the project will cause major losses to the existing fishery resource... Losses to the resource within the project site will occur as a result of inundation of many miles of river and tributary streams. Additional losses will occur as a result of removal of structures within the maximum pool elevation, such as cabins which are owned or rented by persons who engage in angling and including structures associated with fishermen service activities, such as bait dealers and boat liveries. Loss will also occur through abandonment of some of the access roads from periodic inundation of reaches of the river and tributaries above normal operating pool levels.

The length of the Allegheny River affected at various proposed reservoir elevations was described in the August, 1958 FWS report as follows:

The maximum summer low-water regulation pool at elevation 1,328 will have a depth of about 132 feet at the dam and will inundate approximately 27 miles of the river. About 13 river miles will be inundated in Pennsylvania by this pool and approximately 14

miles in New York. The total surface area of this pool will be 12,050 acres. At the reservoir full elevation of 1,365 feet, a pool will be formed which will encompass 21,175 acres and inundate about 13 miles of the river in Pennsylvania and about 22 miles in New York. The depth of the maximum flood storage pool will approximate 169 feet at the dam.

Substantial stretches of tributary streams would also be affected by the proposed project, viz:

Approximately 42 miles of stream, of which 20 miles are considered good trout streams, will be inundated by the maximum summer low water regulation pool. Much of this mileage occurs in Kinzua and Willow Creeks and Sugar Run. The maximum flood storage pool at elevation 1,365 will inundate at infrequent intervals, a total of approximately 75 miles of tributary streams, of which about 26 miles are considered good trout waters. Many tributary streams below elevation 1,333 will be rendered unfit for angling purposes and trout spawning as a result of clearing operations and frequent inundation.

Also, in addition to the loss of the existing stream fishery, annual fluctuation of proposed reservoir levels was expected to adversely affect the high aesthetic values of the area, viz:

Also, the aesthetics of the area will suffer from the annual appearance of an unattractive shoreline, especially in New York, where extensive acreages of gradual gradients are found. Moreover, a prime ingredient in determining the relative value of this pool is a full appreciation of the production and aesthetically attractive qualities of the mainstem river and its tributary streams as they presently exist.

The authors of the August, 1958 FWS report discussed two aspects of the proposed Allegheny Lake project which would partially mitigate, but not

in kind, the loss of stream fishery resources expected to result from impoundment of the Allegheny River. The proposed reservoir was expected to support a substantial recreational fishery, viz:

However, if recommendations included in this report are followed, it is expected that net losses to the fishery may be substantially compensated. It is to be understood, however, that the many high-quality features of the existing environment to be inundated will not be replaced in kind, but the reservoir will offer opportunities for high utilization of a fishery of moderate quality... The fishery potential of the reservoir will be most fully realized if fishery management is practiced. It may be found desirable to stock species of game and forage fish which are adaptable to anticipated conditions in the reservoir and which are not now present in the area. Populations of desirable fish species and their maintenance over long periods of time, could be favored by management practices. Populations of less desirable species may require control to reduce competition and to produce satisfactory reservoir angling for desired species.

While it is anticipated that the reservoir will provide recreation, including angling and boating for large numbers of people, the quality of the angling may fluctuate depending on many factors, some of which are unpredictable at this time. The first years of impoundment will probably provide better than average angling opportunities. However, after the initial period, the quality of the angling may decrease until it reaches a fairly stable level.

Also, an improvement in the fishery in the Allegheny River below the proposed reservoir was expected as a result of more stable stream flows, viz:

Since the reservoir will be used for low-flow augmentation along downstream areas through release of stored waters, it is expected that flows for some distance below the dam will become relatively stable as compared to present flow volumes. As mentioned

earlier an instantaneous minimum flow of at least 500 c.f.s. would be provided. It is anticipated that the fishery resources of downstream areas of the Allegheny River will be improved. While this improvement will not fully compensate for losses to the resources incurred from project construction, it will contribute to mitigation of such losses. According to present plans of the planning agency, the principal outlet works will be placed at the base of the dam. In addition, highlevel release works are now contemplated. Water released from the lower works will be cold during much of the year with temperatures reaching as low as 45 degrees Fahrenheit. By releasing warmer water through the high level system, and mixing it with colder water from the low system, the planning agency hopes to obtain temperatures in the vicinity of 65-70 degrees Fahrenheit immediately downstream from the dam. One of the reasons for this modification in the dam structure and operation is a result of the planning agency's desire to sustain, insofar as possible, suitable water temperatures for bathing activities along the reach of the river below the dam. With release of water at a temperature below the normal summer temperature of the Allegheny River, it may be possible to establish a trout fishery below the dam.

Conclusions drawn by the author of the August, 1958 FWS report concerning probable impacts of project construction on fishery resources were summarized as follows:

In summary, the overall impact of the project on fishery resources and utilization is considered to be as follows: A well-utilized area of distinct natural productivity and uncommon attractiveness will be destroyed. This area involves many miles of tributary trout streams as well as the main-stem fishery. In recompense there will result an improved aquatic environment below the project, with the possibility of establishment of a trout fishery which would probably require artificial maintenance. In further recompense there will develop a substantial and well-utilized fishery in the new reservoir, but the proportion of the more highly-prized game

fishes will probably be of a low-to-moderate order.

A number of specific recommendations designed to achieve partial mitigation of anticipated fishery resource losses and to facilitate appropriate post-project fishery management practices were discussed in the August, 1958 FWS report, as follows:

The planning agency include in its budget requests funds for the acquisition of approximately 40 acres of land on the right side of the Allegheny River approximately 1.5 miles downstream from the proposed Allegheny River Dam to be used as a location for a Federal fish hatchery, together with any language for the appropriation act the planning agency considers necessary to obtain authority for this acquisition.

The planning agency include in its budget requests funds for the construction of two conduits through the right abutment of the dam, one at elevation 1,210 and the other at elevation 1,300, each of sufficient capacity to make available 12 cubic feet per second of water for the proposed Federal fish hatchery, together with any language for the appropriation act the planning agency considers necessary to obtain authority for this construction... Water temperature for hatchery operations should be at about 55 degrees F... One conduit would draw water from an upper reservoir level and the other from the base of the dam. Simultaneous operation of both conduits would provide a degree of temperature control of the hatchery water supply.

Operation of the outlet works be such that the water released from the reservoir will be maintained at 55 degrees - 60 degrees F. from May 1 to October 30... The possibility that water released from the reservoir will be colder than existing water temperatures indicates opportunities for the development of a cold water fishery downstream from the dam site. The distance downstream within which water temperatures would remain sufficiently low for cold water species cannot be definitely established at this time. Should a release-water temperature of 55 degrees-60

degrees F. be provided, suitable habitat for cold water species would probably extend at least as far as Warren, Pennsylvania. With waters released at lower temperatures, improved habitat for cold water species would extend further downstream.

The planning agency maintain a minimum instantaneous flow from the reservoir outlet works of not less than 500 cubic feet per second... The planning agency should direct particular attention to maintaining recommended minimum flows at all times.

The planning agency make every effort to maintain a stable pool level during the months of May and June... A fishery partially supported by shallow-water spawning game-fish species is expected to develop in the reservoir. In order to perpetuate these populations it may be necessary to prevent fluctuations of pool levels, other than those caused by flood water retention, during the spawning period to prevent loss of spawn and consequent population reduction. Stabilization of water levels for this purpose would probably be necessary for a period of several weeks during spring months. Large populations of less desirable warm-water fish species may develop after project construction. To obtain partial control of such populations, drawdowns during spawning periods may be found desirable to destroy spawn. Other measures, such as netting and chemical treatment of certain small areas of the reservoir may also be necessary in addition to, or in place of, drawdowns.

During clearing operations the planning agency provide areas within the reservoir pool levels in which tree stumps are left as cover and spawning sites for fish populations... Recommendation "g" provides for the establishment of a number of areas within the reservoir pool levels in which tree stumps are left as cover and spawning sites for various fish species. Provision of such areas would facilitate the maintenance of game, pan and forage fish populations. The stumps would require staking in such a manner as to prevent their floating. The location and size of the areas, and the method of staking, would be worked out at a later date in coordination with the planning agency, the Pennsylvania Fish Commission and the New York Department of Conservation.

Oil and gas wells within the project site be sealed.

Lands and waters in the project area be open to free use for hunting and fishing, except for sections reserved for safety, efficient operations, or protection of public property.

Leases of Federal land in the project area stipulate the right of free public access for hunting and fishing.

May 9, 1961 FWS Report

The May 9, 1961 FWS letter report (6) with appended substantiating report (7) constituted the final FWS statement to the CE concerning anticipated impacts on fishery resources occasioned by construction of the Allegheny Lake project. Much of the information and the major conclusions presented in the May 9, 1961 FWS reports were based on data contained in the previously submitted August, 1958 FWS report. However, the May 9, 1961 FWS reports provided additional specific data delineating man-day use and monetary values associated with predicted project impacts on fishery resources.

Construction of the Allegheny project was expected to eliminate existing recreational fisheries from approximately 82 km (51 mi) of stream habitat as a result of permanent inundation, frequent flooding and removal of stream bank vegetation (Table 12). The expected loss of stream habitat included some 45 km (28 mi) of the Allegheny River, of which 21 km (13 mi) was located in Pennsylvania and 24 km (15 mi) in New York, plus 37 km (23 mi) of tributary trout streams [31 km (19 mi) in Pennsylvania and 6 km (4 mi) in New York].

Table 12 -- Allegheny Lake Project. Summary of estimated losses of stream habitat and associated fishing man-day use with the project in place. Extracted from data provided in the May 9, 1961 FWS report (7)

	New York	Pennsylvania	Total
<u>Allegheny River</u>			
<u>Stream length</u>			
Km	24	21	45
Mi	15	13	28
<u>Angling pressure</u>			
No. man-day/km	75	510	-
No. man-day/mi	120	325	-
Total no. man-day	1,800	10,700	12,500
Monetary value(\$)	5,400 ^{1/}	32,100 ^{1/}	37,500
<u>Tributary trout stream</u>			
<u>Stream length</u>			
Km	6.3	30.4	36.7
Mi	3.9	18.9	22.8
<u>Angling pressure</u>			
No. man-day/km	6	228	-
No. man-day/mi	10	367	-
Total no. man-day	390	6,944	7,334
Monetary value(\$)	585 ^{2/}	13,790 ^{3/}	14,375
<u>Total</u>			
No. km of streams	30.4	51.3	82
No. mi of streams	18.9	31.9	51.0
No. man-day	2,200	17,600	19,800
Monetary value(\$) ^{4/}	6,000	45,900	51,900

^{1/}Reflects a value of \$3 per fishing man-day in the Allegheny River.

^{2/}Reflects a value of \$1.50 per fishing man-day on two small trout streams

^{3/}Reflects a value of \$2.00 per day assessed for 6,750 fishing man-days on 21.7 km (13.5 mi) of one large trout stream plus a value of \$1.50 per fishing man-day on 8.7 km (5.4 mi) of small trout streams

^{4/}Rounded

Estimated angling pressure on the affected segment of the Allegheny River in Pennsylvania, 500 man-days/km (825/mi), was substantially higher than for New York [75 man-days/km (120/mi)]. A total of 10,700 angler man-days per year valued at \$32,100 was estimated for the 21 km (13 mi) sector in Pennsylvania as contrasted to only 1,800 man-days per year valued at \$5,400 in the slightly longer (24 km (15 mi)) Allegheny River stream segment in New York.

The recreational trout fishery supported by Pennsylvania streams (estimated at 6,944 man-days/year valued at \$13,790 annually) was also much more extensive than the total of 390 man-days/year valued at \$585 annually for New York waters. The overall annual loss of angler man-days anticipated as a result of project construction totaled some 19,800 man-days valued at \$51,900. Approximately 89 percent (17,600 man-days valued at \$45,900) of the predicted loss was expected to occur in Pennsylvania waters. The much lower estimated of angler man-day use for New York waters was attributed to the fact that most of the streams suitable for angling were located within the Allegany Indian Reservation. Non-Indian anglers were required to purchase a special license to fish within the reservation which discouraged non-Indian fishing participation.

A highly valuable recreational fishery was expected to develop in Allegheny Lake as a result of the general attractiveness of the project site, the large and growing population within an easy driving distance of the area, and the quality of the water to be impounded (7), viz:

The territory in the immediate vicinity of the project site is well established as a summer resort and recreational area. Factors contributing to this type of use are many, but the principal reason appears to be the extensive tracts of public lands in the area that are perpetually available to the public. Once the reservoir is developed and operating, the present area will be even more attractive to recreation seekers, particularly fishermen, over a wider area than under without-the-project conditions.

Based on Bureau of Census population projections, it is estimated that 11,000,000 people, representing segments of the populations of Pennsylvania, New York, Ohio, and West Virginia, reside within comparatively easy driving distance of the area. Included in this group are approximately 770,000 licensed fishermen and about 260,000 unlicensed children and retired adults who fish. Depending upon the quality of the project fishery and the convenience and adequacy of access and day-use facilities, a large segment of these sportsmen are potential users of the newly-created fishery resources. To the above number of fishermen may be added an additional 230,000 potential users, an average of the expected increase in the number of fishermen within drawing radius of the reservoir during a period equal to the economic project life.

Based on the quality of the waters to be impounded, the depth and configuration of the reservoir site and proposed operational plans, a highly valuable fishery is expected to develop and be sustained for many years in the Allegheny Reservoir. The summer pool, on which the reservoir fishery will be based primarily, will average about 50 feet in depth. About 5,000 acres of this 12,050 acre pool will be productive of warm water fish species. Deeper portions of the reservoir should be suitable for the maintenance of a somewhat less valuable trout fishery.

Assuming no special effort to develop fisherman access facilities, the FWS predicted that the post-project recreational fishery in Allegheny Lake over the 50 year economic life of the project would average 120,500

angler man-days per year with a total monetary value of \$180,750 at \$1.50 per angler man-day. Seasonal upstream spawning migrations from the lake (walleyes, suckers, etc.) were predicted to support an additional 12,000 angler man-days per year valued at \$12,000 (\$1.00 per man-day). Thus, the recreational fishery above Kinzua Dam was predicted by the FWS to total some 132,500 man-days per year valued at \$192,800 (6), viz:

Considering the number of potential fishermen within reach of the project area, it would not be unreasonable to expect that the reservoir would receive an average of about 120,500 man-days of angling pressure each year if unmanaged and without special attention given access development. In this case, it would be expected that fishermen would gain access to the reservoir from the highways and roads that are proposed for relocation and development as a project feature. Because the reservoir fishery is expected to be of high quality the value of a fisherman day is considered to be \$1.50. Therefore, the annual sport fishing value of the Allegheny River Reservoir, fishery is estimated to be \$180,800.

Due to the variety of fishes expected to inhabit the reservoir, it is probable that several species will establish annual spawning runs up the mainstem into New York State. Species such as walleyes and suckers are particularly vulnerable to angling during spawning migrations. Such runs should provide about 30 days of high quality fishing each year to anglers in New York State, while it is difficult to appraise the total amount of fishermen use provided by a fishery of this kind, it may be conservatively estimated that upstream reaches will receive about 12,000 man-days of use each year based upon this resource alone. This quality of fishing use is appraised at \$1.00 per man-day, or \$12,000 per annum.

As the pre-project fishery upstream from the Kinzua Dam provided some 19,800 angling man-days per year valued at \$51,900, the lake fishery was expected to provide a net incidental benefit of 112,700 man-days

valued at \$140,900 (6), viz:

The reservoir will affect fish and wildlife resources and their utilization throughout 100 miles of Allegheny River valley. Without-the-project, fishery resources, within the reservoir site itself will have an average annual value of \$51,900. Although this value will be destroyed, it will be replaced by a reservoir fishery and improved upstream fishery resources, so that new values in the amount of \$192,800 will be realized. This represents an incidental benefit from the reservoir in the amount of \$140,900 annually.

With provision of adequate angler access facilities, the authors of the May 9, 1961 FWS letter report predicted that the post-project lake fishery could be more than doubled (from 120,500 to 300,000 angler man-days/year) with a comparable increase in monetary value (6), viz:

Measures to provide for adequate access and reservoir management to encourage maximum sport fishing use should increase the estimated number of fisherman-days annually to a total of 300,000, rather than the anticipated use amounting to 120,500 days the reservoir will receive without any special provisions for fishermen. This increased use represents an added annual value in the amount of \$257,200. To accomplish this increase approximately 40 fishing access sites would be required. It appears, however, that the development of 40 access sites around the shores of the impoundment might preclude adequate provision of facilities for other justified recreation uses of the impoundment because of the limitation of the terrain. The National Park Service suggests that joint study and consideration be given to the formulation of a balanced plan for the preservation and utilization of the recreational resources. We concur with this suggestion on the assumption that adequate provision will be made in that plan for maximum use of project lands and included water areas by hunters and anglers.

In your letter of April 21, 1961, you state that you have located 9 excellent sites for public use and

access development in Pennsylvania. Additional sites suitable for fishing access distributed so as to serve New York portions of the reservoir as well as Pennsylvania should be developed in such a way as to facilitate fishing use.

A decrease in average summer water temperature of the Allegheny River anticipated with project construction and operation was expected to affect the existing (pre-project) warmwater fishery as far downstream as Oil City, Pennsylvania located some 105 km (65 mi) below the proposed Kinzua Dam (7), viz:

As indicated previously, the upper reaches of Allegheny River presently supports a sparse population of brown and rainbow trout. Because of this, and the fact that water temperatures seldom raise above 75 degrees F, the reach of river in the project vicinity now may be considered marginal for trout. Therefore, a relatively small decrease in average summer water temperatures could convert the existing bass habitat to one favoring trout. The extent to which release waters will influence downstream reaches will depend on whether a preponderance of the summer maintenance flows are discharged from the sluices at an elevation of 1,205 feet, where the water is expected to average about 45 degrees F, during the summer, or from the sluices at the 1,300 foot elevation where water temperatures would average about 60 degrees F.

The scope of the impact on the existing smallmouth bass fishery, under various temperature discharge regimes, was discussed in the May 9, 1961 FWS letter report, as follows:

Our analysis of the downstream effects extend 65 miles to the vicinity of Oil City, Pennsylvania. Allegheny River, within this reach, constitutes an excellent warmwater fishery, with smallmouth bass the predominant game fish. Current sport fishing value within these 65 miles is estimated to be \$366,300 annually.

Depending upon maximum temperatures and fluctuations of temperatures, water released from Kinzua Dam will create trout habitat for varying distances downstream. Should releases be manipulated so that water temperatures in the river at the dam were held closely at 45 degrees, the entire 65 miles would be converted from smallmouth bass to trout habitat. The river downstream, however, would be quite unproductive for a considerable distance because temperatures would be too low. Also, this entire reach would lose its ability to serve the large numbers of fishermen interested in smallmouth bass fishing.

On the other hand, if releases were to be manipulated to produce 60 degrees F temperatures in the river at the dam, about 30 miles of trout habitat would be created. Anticipated trout fishing use could be concentrated in that reach without detriment to the quality of the sport fishery resulting from overcrowding. Under these conditions a minimum of stream would be converted to a cold-water fishery. This is favored by the Pennsylvania Fish Commission, which feels that as much of the present warmwater fishery should be preserved as possible, especially since it is self-sustaining and of high quality. Your agency favors this because it would result in minimum disturbance of swimming and other recreational activities downstream, aside from hunting or fishing.

In our judgment, the best interests of the fishermen would be served by providing conditions as nearly as possible midway between the 2 extremes mentioned above. We believe that optimum as well as maximum fishery benefits in the overall 65 mile reach would result from manipulation to hold water temperatures as close to 55 degrees F as possible at all times, thus creating about 45 miles of cool water which would provide good trout habitat throughout, with the other 20 miles retaining essentially its present qualities.

Under this condition, total annual recreational fishing value would amount to \$868,800. This represents an annual benefit of \$502,500 over without-the-project annual fishery value, a gain of \$110,700 in net annual benefits compared to conditions based on 60 degrees F water temperatures at the dam, and a gain

of \$283,800 in net annual benefits compared to 45 degrees F water temperatures at the dam. Naturally, in view of this and the great number of people interested in both trout and smallmouth bass fishing, we urge that releases be managed so as to provide as nearly as possible for 55 degrees F tailwater temperature.

It was noted by the authors of the May 9, 1961 FWS letter report that angling man-day use in the Allegheny tailwater could be further increased if additional access areas were acquired and developed, viz:

Benefits would be further increased, in the amount of \$135,500 annually, if access were improved, especially within the reach converted to trout habitat. The minimum cost of land acquisition and minimum facilities to provide this access is estimated to be \$350,000.

However, this suggestion was immediately discounted because of expected difficulty in locating adequate access sites, as follows (op. cit.), viz:

The Forest Service points out, however, that the lands they control along the left bank of the Allegheny River are narrow, extremely steep segments between the highway and the river, having little recreational use value. In fact, a survey they made indicated only one suitable site between Kinzua Dam and Tionesta. The same situation may prove to be the case along the right bank where, except for some frontage owned by the State of Pennsylvania, suitable areas for development of access sites, if such there are, would have to be carved from private holdings. We must conclude that, while desirable, the provision of additional access to encourage increased fishing use downstream does not appear feasible.

It will be noted that the highest values predicted by the FWS for the total project fishery were achieved by a combination of extensive access

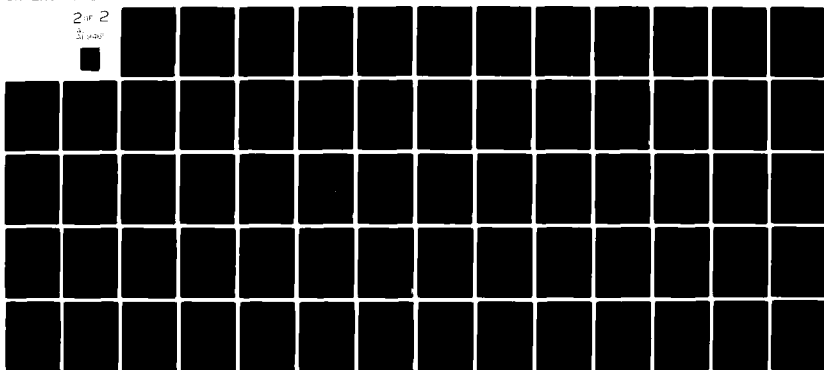
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development at the lake plus manipulation of water release discharge regimes below the dam to provide an average summer temperature of 12.8 degrees C (55 degrees F) in the tailwater. This combination was estimated to provide some 312,000 angling man-days per year valued at \$450,000 above the dam and 289,600 angling man-days valued at \$868,800 in the tailwater. The total post-project fishery predicted under this management regime amounted to 601,000 angling man-days per year valued at \$1,318,880 and exceeded without-the-project estimates of angling man-day use by 459,600 man-days per year and without-the-project monetary values by \$900,600 per year (Table 13).

The recommended tailwater temperature regimes [12.8 degrees C (55 degrees F)] with the project in place was expected to reduce the existing (without-the-project) smallmouth bass fishery in the Allegheny River by 34,500 man-days per year, (from 122,100 to 87,600, man-days per year) annually as a result of decreased water temperature over a 72 km (45 mi) stretch downstream from the dam site to Tionesta, Pennsylvania. However, the authors of the May 9, 1961 FWS report predicted that a trout fishery (based on stocked fish) could be developed within this stream segment which would provide 202,000 man-days of trout fishing for an overall net of 167,500 man-days per year and an annual monetary value of \$502,500 with the project in place.

To accommodate the large number of trout required for the proposed stocking program, the FWS recommended the construction of a trout

Table 13. -- Allegheny Lake Project. Comparison of the monetary value and number of angler man-day use within the project impact area without the project and with the project in place. Extracted from data provided in the May 9, 1961 FWS reports (6,7)

	Trout Fishery		Warm Water Fishery*		Total Fishery	
	No. man days	Value(\$)	No. man days	Value(\$)	No. man days	Value(\$)
Fishery below dam site						
Without project	---	---	122,100	366,300	122,100	366,300
With project						
@ 7.2°C (45°F) tailwater	195,000	585,000	---	---	195,000	585,000
net with project	+195,000	+585,000	-122,100	-366,300	+72,900	+218,700
@ 15.5°C (60°F) tailwater	150,000	450,000	102,700	308,100	252,700	758,100
net with project	+150,000	+450,000	-19,400	-58,200	+130,600	+391,800
@ 12.8°C (55°F) tailwater	202,000	606,000	87,600	262,800	289,600	868,800
net with project	+202,000	+606,000	-34,500	-103,500	+167,500	+502,500
Fishery above dam site						
Without project	7,300	14,400	12,500	37,500	19,800	51,900
With project						
w/o spec. access	---	---	132,500	192,800	132,500	192,800
net with project	-7,300	-14,400	+120,000	+155,300	+112,700	+140,900
with spec. access	---	---	312,000	450,000	312,000	450,000
net with project	-7,300	-14,400	+299,500	+412,500	+292,200	+398,100
Total Project Fishery						
Without project	7,300	14,400	135,000	403,800	141,900	418,200
With project						
@ 12.8°C (55°F) tailwater	202,000	606,000	220,100	455,600	422,100	1,061,600
and w/o spec. lake access	+194,700	+591,600	+85,100	+51,800	+280,200	+643,400
net with project	202,000	606,000	399,600	712,800	601,600	1,318,800
@ 12.8°C (55°F) tailwater	202,000	606,000	399,600	712,800	601,600	1,318,800
and with spec. lake access	+194,700	+591,600	+264,600	+309,000	+459,700	+900,600
net with project						

* The warm water fishery was primarily for smallmouth bass in the Allegheny River. The lake fishery was expected to consist of smallmouth bass, largemouth bass, walleye, crappie and bluegill and some trout in the deeper, colder water.

hatchery below the dam, as follows (6):

An additional facility is needed to assure adequate fishery resources to meet present and future demands. The trout waters created below the dam will need to be stocked with fish since the stream itself does not offer satisfactory spawning habitat to assure adequate natural reproduction. Waters behind the dam will also require additional supplies of fish for stocking. Fortunately, Allegheny Reservoir can supply the necessary water requirements and there is a suitable location for a National Fish hatchery a short distance downstream from the dam. Specific authority for establishment of a fish hatchery in northwestern Pennsylvania was provided by Public Law 86-205, enacted August 25, 1959.

It is estimated that this facility will cost \$973,000 and it will be capable of producing 150,000 pounds of trout annually. Space will also be provided to increase the rearing facilities to meet future demands. It is anticipated that funds for establishment of the hatchery will be appropriated by Congress directly to the Department of the Interior, Bureau of Sport Fisheries and Wildlife.

Those features which must be incorporated in the design of the dam and reservoir in order to provide water of satisfactory quantity and temperature for hatchery operations will be designed by the Corps of Engineers and included in project costs, in accordance with understandings reached between your agency and this Bureau. In essence these features will consist of an upper outlet pipe at elevation 1,300, with a capacity of 35 c.f.s. with pool surface at elevation 1,328, and a lower outlet pipe at elevation 1,225 with a capacity of 35 c.f.s. with pool surface at elevation 1,267.

Fishery Resources -- Post-impoundment Occurrences

Quantitative information describing the post-impoundment Allegheny Lake recreational fishery was not available prior to the current evaluation. To acquire the necessary data upon which to base a reasoned appraisal of the pre-construction planning documents, a one-year study of the lake fishery was conducted under terms of a subcontract [No. DACW-31-79-C-0005(3)] negotiated with the Pennsylvania State University (PSU). This study was conducted from April 1, 1979 through March 31, 1980. Dr. Edwin L. Cooper served as the Principal Investigator, assisted by Charles C. Wagner. Specific study goals included an analysis of the fish community, identification of critical water quality characteristics of the reservoir and a survey of angler-use and harvest. The completed report for the study, submitted to the Sport Fishing Institute in June, 1980, comprised the primary information source upon which the following section is based (21).

Stocking

Largemouth bass, walleye, northern pike, and muskellunge were planted to establish a dominance of predators during the early years of impoundment (Table 14). Despite this, a tremendous hatch of carp from a few resident adults flooded the lake with 13-18 cm (5-7 in) young carp by September, 1967. The introduced largemouth bass also flourished during the first two years, but have never recovered to their initial abundance. Although smallmouth bass have never been stocked, it is interesting to note that this species is now abundant in the reservoir.

Table 14. Allegheny Lake. Number of fish stocked (in thousands) in Allegheny Lake over period from 1966 to 1979, inclusive

Year	Largemouth Bass ^{1/}	Walleye ^{2/}	Muskellunge ^{3/}	Northern Pike ^{4/}	Channel Catfish ^{5/}	Trout ^{5/}
1966	830					
1967	980	3,000	50		0.275	
1968	200		152	515	67.4	
1969	300	800	1.4	1,200	152	
1970	4		52	2,000	37	
1971	24					
1972						
1973		1,600				
1974		2,500				^{5/}
1975		3,000				^{5/}
1976		5,00				^{5/}
1977		2,800				^{5/}
1978		2,000				^{5/}
1979			15			^{5/}

^{1/} Largemouth bass stocked as fingerling [2.5 to 5 cm (1 to 2 in)] except for 23,750 advanced fingerling [5.1 to 12.7 cm (2 to 5 in)] stocked in October, 1968

^{2/} Walleye and northern pike stocked as swim-up

^{3/} Muskellunge stocked as fingerlings [10.2 to 30.5 cm (4 to 12 in)]

^{4/} Channel catfish stocked as fingerlings [5.1 to 12.7 cm (2 to 5 in)] except for 10,700 sub-adults [20.3 to 25.0 cm (8 to 10 in)] stocked in 1970

^{5/} Approximately 10 to 30 thousand brown trout and/or rainbow trout were stocked each year in tributaries to the Lake

The 1967 planting of walleyes showed up in the 1969 netting. After a hiatus of several years of no-stocking (and concurrent low abundance of adult walleye), the resumption of heavy plantings of walleye fry over the 6-year period from 1973 to 1979 is believed to have been responsible for the present large population of this species. A one-year hiatus of stocking (1979) has been programmed in the management plan for the lake as a means of evaluating the importance of the stocking program in recruiting the adult walleye population. It is known that some natural reproduction of the walleye now occurs.

Other introductions to the lake which have been successful include the channel catfish, northern pike, (which may have been present but not previously collected) and the emerald shiner (which was introduced from Lake Erie, but was common in the lower part of the Allegheny River prior to impoundment). Other species were inadvertently introduced. These include the spottail shiner (probably included by error with emerald shiner from Lake Erie), and an occasional coho salmon added by enthusiastic anglers. Some consideration has been given to the introduction of rainbow smelt, but this has not yet occurred. The white bass, previously present in the watershed in small numbers, is now well established in the lake and is increasing in abundance in the river below the dam.

Fish Community sampling (Allegheny Lake)

The fish population of Allegheny Lake was sampled annually from 1967

through 1979 by the FWS (Division of Fishery Assistance). Additional sampling was conducted in 1979 by PSU under terms of subcontract investigation (21).

Gill-netting constituted the primary fish sampling technique employed in Allegheny Lake. The gill nets used in the investigation were each 38 m (125 ft) in length and consisted of a gang of five 7.6 m (25 ft) sections of different mesh sizes ranging from 2.5 cm (1 in) to 5.0 cm (2 in) bar mesh. The nets were set overnight for about 20 hours, either tied to the shoreline or fished on the bottom at an angle along the littoral shore extending into deep water. Three to five nets per day were usually employed. Catch data were recorded as the number of fish caught per 100 net hours.

Sampling intensity over the 13 year sampling period (1967-1979) varied from a low of 124 net hours in 1968 to a high of 2,088 net hours in 1975 and was higher during the latter years of the survey (Table 15). An average of 977 net hours were fished annually, which is equivalent to five nets set overnight (20 hours) on approximately 10 occasions per year.

Four large predator species (walleye, northern pike, muskellunge and channel catfish) registered substantial increases in capture rate (well over 100 percent) over the last nine years of sampling as compared to the first four years of impoundment. Largemouth bass, on the other hand, experienced a decline in capture rate during later years.

Table 15. -- Allegheny Lake. Species composition of catch by gill net in Allegheny Reservoir for period 1967-1979. Values in table are catch per 100 hours per net; one net is made up of five, 7.6 m (25 ft) sections with mesh sizes ranging from 2.5 cm (1 in) to 5 cm (2 in)

	Year sampled													Average	
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1967-70	1971-79
Number of net hours	465	124	204	181	645	973	1,315	641	2,088	1,410	1,892	1,310	1,449	244	1,303
Catch per net hour															
Walleye	4	1	10	5	2	1	1	1	4	14	28	35	78	5	18
Smallmouth bass	4	2	10	13	7	8	12	5	14	9	9	7	7	7	9
Largemouth bass	2	1					1		1					0.75	0.22
Channel catfish					3	4	3	4	2	9	7	8	5	0.0	5
Muskellunge			1			1	1	1	1	1	1	1	1	0.25	1
Northern pike				3	2	1	2	1	1	2	2	3	1	0.75	1.7
Brown trout	2			1	2	1	1	1	1	2	4	2	2	0.75	1.8
Carp	116	49	98	64	36	19	7	2	4	13	25	16	9	82	15
White sucker	40	20	2	31	17	26	10	2	4	5	6	5	7	23	9
Yellow perch	15	6	23	9	38	26	25	20	21	5	2	1	11	13	17

Other species taken in gill nets: Rainbow trout, golden shiner, northern hog sucker, quillback, redbreasted, black, golden, shorthead, river, and silver), brown and yellow bullhead, white bass, rock bass, bluegill, pumpkinseed, white and black crappie.

The smallmouth bass, although never stocked, maintained its position as one of the dominant predator species in the lake fish community throughout the 13-year sampling period. Contrary to FWS predictions, carp and white sucker populations declined substantially (more than 50 percent) from earlier years, but remain as important components of the population.

Many other species large enough to be captured in gill nets were collected, such as five species of redhorses, quillback, brown and yellow bullhead and yellow perch. The mean length of the walleye sampled during the 1979 gill-netting investigation was between 33 and 36 cm (13-14 in). Some 675 walleye of the total of 1,067 walleye collected by gill-netting were under the 38.1 cm (15 in) legal minimum length limit for a ratio of 1:2.55 legal size to sub-legal size walleye (Table 16).

In addition to gill netting, the lake was sampled periodically by electrofishing. Although less sampling effort was spent electrofishing than gill-netting, the electrofishing samples provided helpful supplemental information concerning the species composition of the lake fish community. In the period from 1969 to 1975, electrofishing was done in the daytime, mostly in the upper portion of the lake. Only a few walleye, which are seldom found near the lake surface during the daytime, were collected.

Several commonly creel species, which were not abundant in the gill-netting samples (black and white crappie, pumpkinseed, yellow perch), were represented in the electrofishing samples (Table 17).

Table 16. -- Allegheny Lake. Length frequency of walleyes captured by experimental gill nets during 1979

Length interval		Number of walleyes caught during period:			Total
Cm	Inches	April-May	June-July	August-November	
13.0-15.4	5.1- 6.0	--	--	1	1
15.5-17.8	6.1- 7.0	--	1	22	23
17.9-20.3	7.1- 8.0	17	13	7	37
20.4-22.9	8.1- 9.0	20	36	--	56
23.0-25.4	9.1-10.0	7	51	4	62
25.5-27.9	10.1-11.0	--	15	22	37
28.0-30.5	11.1-12.0	1	--	88	89
30.6-33.0	12.1-13.0	8	11	161	180
33.1-35.6	13.1-14.0	28	34	81	143
35.7-38.1	14.1-15.0	44	65	30	139
Subtotal		125	226	416	765
38.2-40.6	15.1-16.0	20	39	81	140
40.7-43.2	16.1-17.0	7	7	60	74
43.3-45.7	17.1-18.0	7	8	21	36
45.8-48.3	18.1-19.0	2	7	5	14
48.2-50.8	19.1-20.0	2	5	4	11
50.9-53.3	20.1-21.0	2	2	3	7
53.4-55.9	21.1-22.0	1	3	1	5
57.0-58.4	22.1-23.0	--	1	3	4
58.5-61.0	23.1-24.0	1	1	1	3
61.1-63.5	24.1-25.0	--	1	4	5
63.6-68.6	26.1-27.0	--	--	1	1
Subtotal		42	74	184	300
Grand total		167	300	600	1,067

Table 17. -- Allegheny Lake. Number of fish caught by daytime electrofishing. The total number of hours fished each year in parentheses

Species	Average		1969 (3.2)	1970 (4.5)	Sampling			
	No.	%			1971 (4.1)	1973 (6.3)	1974 (5.0)	1975 (8.0)
Brown trout	0.7	0.2	--	--	--	--	4	--
Muskellunge	0.8	0.2	--	--	--	3	--	2
Northern pike	3.8	1.1	--	--	4	6	2	14
Carp	11.2	32.4	157	157	58	275	--	1
Golden shiner	9.1	2.6	2	2	--	3	48	--
Common shiner	4.5	1.3	9	7	1	2	8	--
Quillback	4.2	1.2	1	7	2	9	--	6
Hogsucker	2.3	0.7	6	3	1	2	2	--
Redhorses	32.7	9.5	39	56	27	19	5	50
White sucker	9.0	2.6	1	3	3	12	31	4
Channel catfish	0.3	tr.	--	--	--	--	--	2
Yellow bullhead	0.5	0.1	--	2	--	--	--	1
Brown bullhead	2.3	0.7	5	2	--	5	1	1
White bass	0.2	tr.	--	--	--	--	--	1
Largemouth bass	5.0	1.4	8	10	5	2	5	--
Smallmouth bass	14.8	4.3	9	3	10	13	16	48
Black crappie	5.2	1.5	5	3	6	17	--	--
White crappie	38.8	11.2	5	3	104	74	46	1
Rock bass	1.2	0.3	--	--	1	--	2	4
Pumpkinseed	23.5	6.8	63	17	12	5	25	29
Bluegill	4.3	1.2	16	1	3	1	1	4
Yellow perch	69.3	20.1	143	63	63	30	50	67
Walleye	1.0	0.3	--	--	2	--	1	3

Tr. - Trace

Electrofishing was done at night (from dusk to 11 p.m.) during subsequent years. In 1979, a 3 hour electrofishing sample obtained from the Kinzua area of the lake produced a large number of walleye along with numerous smallmouth bass, several species of redhorse, carp and white sucker (Table 18). Several other species which were too small to appear in gill netting collections were taken by electrofishing. These species included the log perch, bluntnose minnow, spottail shiner and emerald shiner. The capture of a 7.6 cm (3 in) young-of-the-year walleye by electrofishing was evidence that walleye spawned successfully, as no walleye had been stocked during 1979.

A list of the fish species recorded for the Allegheny River and/or Allegheny Lake is presented in Table 19. This list includes 77 species recorded from surveys conducted by the FWS, PFC, and PSU between 1958 and 1979.

Thirty-two species native to the Allegheny River system were collected in Allegheny Lake. Five additional species were collected in Allegheny Lake which represented either purposeful introduction by PFC (channel catfish, northern pike, emerald shiner) or inadvertent introductions (spottail shiner). A few coho salmon, which were assumed to have been stocked by anglers, were also reported from the lake.

Tailwater fish community sampling

The PFC initiated a post-impoundment tailwater fishery survey on the Allegheny River below Kinzua Dam in 1969 which continued through 1974

Table 18. -- Allegheny Lake. Number and total length of fishes in cm (in) caught by electrofishing at night for 3 hours in the Kinzua Arm, 12 July, 1979

Species	Number	5.3-10.2 (2.1-4.0)	10.3-15.2 (4.1-6.0)	15.3-20.3 (6.1-8.0)	Range of total length in cm (in)						
					20.4-25.4 (8.1-10.0)	25.5-30.5 (10.1-12.0)	30.6-35.5 (12.1-14.0)	35.6-40.6 (14.1-16.0)	40.7-45.7 (16.1-18.0)	45.8 (18.1)	
Walleye	60	1		6	40	2	4	5	1	1	
Carp	24							5	19	1	
Smallmouth bass	23	2	4	7	6	1	3				
Golden redbreast	20			1	2	4	4	5	4		
White sucker	19		1	15	2		1				
Spottail shiner	14	14									
Shorthead redbreast	9			5	3	1					
Black redbreast	9							4	4	1	
Logperch	7	4	3								
Quillback	4		1	1			1		1		
Yellow perch	4	1	2	1							
Rock bass	2		1	1							
Bluntnose minnow	2	2									
Emerald shiner	2		2								
Northern hogsucker	1				1						

Table 19. -- Allegheny Lake. Summary of fish species reported from Allegheny Lake and the Allegheny River below Kinzua Dam within the project impact area, 1958-1979. Based on species lists reported by PSU (24) and by PFC (25)

Petromyzontidae	Gadidae
Ohio lamprey, A	Burbot, A
Allegheny brook lamprey, A	
American brook lamprey, A	
	Ictaluridae
Lepisosteidae	Yellow bullhead, A, R
Shortnose gar, A	Brown bullhead, A, R
	Stoneroller, A, R
Anguillidae	Channel catfish, I
American eel, A	Madtom, A
	Flathead catfish, A
Salmonidae	
Brook trout, R	Gasterosteidae
Brown trout, A, R	Brook stickleback, A
Rainbow trout, A, R	
Coho salmon, I	Percopsidae
	Trout-perch, A
Esocidae	
Muskellunge, A, R	Percichthyidae
Northern pike, I	White bass, R
Cyprinidae	Centrarchidae
Stoneroller, A	Rock bass, A, R
Carp, A, R	Pumpkinseed, A, R
Bigeye chub, A	Bluegill, A, R
River chub, A	Smallmouth bass, A, R
Streamline chub, A	Largemouth bass, A, R
Gravel chub, A	White crappie, R
River chub, A	Black crappie, R
Cutlip minnow, A	
Golden shiner, A, R	Percidae
Common shiner, A	Greenside darter, A
Silver shiner, A	Rainbow darter, A
Rosyface shiner, A	Bluebreast darter, A
Emerald shiner, I	Fantail darter, A
Spottail shiner, I	Spotted darter, A
Sand shiner, A, R	Johnny darter, A
Mimic shiner, A, R	Tippecanoe darter, A
Tonguetied minnow, A	Variegate darter, A
Bluntnose minnow, A, R	Banded darter, A
Fathead minnow, R	Yellow perch, A, R
Blacknose dace, A	Logperch, A, R
Longnose dace, A	Channel darter, A
Creek chub, A	Quilt darter, A
Pearl dace, A	Longhead darter, A
	Blackside darter, A
Catostomidae	Slenderhead darter, A
Quillback, A, R	Walleye, A, R
White sucker, A, R	
Northern hog sucker, A, R	Cottidae
Silver redhorse, A, R	Mottled sculpin, A
Golden redhorse, A, R	
Shorthead redhorse, A, R	
Black redhorse, A, R	
River redhorse, R	

A. Present in the Allegheny River below Kinzua Dam.

R. Native species remaining as spawning population in the lake, or a common migrant from tributary streams.

I. Introduced into lake as exotics.

(22). Fish collections were obtained primarily by electrofishing along with supplemental sampling by seining and gill netting.

Some 69 species of fish were recorded during the survey including three species listed on Pennsylvania rare and endangered species list (tippecanoe darter, longhead darter and slenderhead darter). Major recreational fish species evaluated during the survey included the smallmouth bass, largemouth bass, walleye, muskellunge and northern pike.

Adequate smallmouth bass reproduction was found throughout the project impact area each year of the survey and was considered excellent in 1970 and 1971. Smallmouth bass spawning in the 11 km (7 mi) section of the Allegheny River immediately below Kinzua Dam appeared to be delayed from one to three weeks as a result of cooler water released from Allegheny Lake.

Although sporadic reproduction by largemouth bass was noted in isolated backwater areas of the Allegheny River, the species was not considered as an important component of the recreational fishery (22), viz:

The largemouth cannot be considered as an important part of the river fishery even though it does provide some recreation. It would not be feasible to attempt to manage largemouth bass as a part of the fishery of the Allegheny.

Information concerning spawning success of walleye was equivocal (op. cit.), viz:

After five years of sampling no definite assessment of walleye reproduction can be made. Results of

sampling and a 20 mile fish kill indicate a very low density of juvenile walleye; however, year class strengths have been relatively uniform throughout the five year study.

Since 1970 only four young-of-year walleye have been collected. From this information the project leader has come to two possible conclusions:

1. Due to selectivity of gear, juvenile walleye are not captured during survey work.
2. Present walleye populations are the result of recruitment from areas other than the study area.

Definite evidence of successful muskellunge reproduction on the other hand, was available (op. cit.), viz:

It has been definitely established that muskellunge natural reproduction is occurring in the Allegheny River. Fingerling ranging from 4.2 to 23.0 cm were collected in 1973 and 1974. No muskellunge fry were stocked during these two years. Since muskellunge are indigenous to the Upper Allegheny River, natural reproduction was not considered unusual.

A total of 9 muskellunge fingerling were taken by seining and electrofishing. Seining efforts in 1973 by the Tionesta Hatchery crew resulted in approximately one muskellunge per 160 man-hours of seining. Electroshocking efforts in 1974 resulted in the capture of 3 muskellunge fingerling or one fingerling per 72 hours of electrofishing.

A fish population survey was conducted in the fall of 1979 by PSU over a 24 km (15 mi) stretch of the Allegheny River tailwater immediately below the Kinzua Dam (21), viz:

The Allegheny River below Kinzua Dam for a distance of 15 miles supported a diverse fish population in the fall of 1979 of no less than 34 species. All but two of these (one specimen each of the grass pickerel and the reidside dace) have been previously

collected from this portion of the river. Most of these are common inhabitants of the area, either in the main river or tributary waters.

This electrofishing was useful in documenting three aspects of this fish population which may have been influenced by the dam construction, as follows:

1. Smallmouth bass are successfully spawning and surviving over the entire river system up to the first station which was only 0.25 mile below Kinzua Dam. Apparently, the cold water released from the reservoir and the higher minimum flows in summer did not completely disrupt natural reproduction of this species. The same conclusion was reached by Ronald Lee of the Pennsylvania Fish Commission in his 1971 survey of the river.
2. Three of the shiners (rosyface, sand, and mimic) which were common in the river before impoundment are now rare in the river above Warren. This is probably due both to the cooler water and stronger current that exists here as a result of water released from the reservoir.
3. Three other species (spottail shiner, yellow perch and the walleye) have greatly increased their abundance in the river above Warren. These are undoubtedly spilling over the dam from the very large populations in the reservoir, but contribute significantly to the river population for a distance of only about 7 miles.

Water quality

Vertical oxygen and temperature profile were obtained in 1979 by the PSU at the mouth of Sugar Bay, located approximately 8 km above the dam. The sampling station was located at a point assumed to be above any influence from the pumped storage facility which was located immediately above the dam. The profiles were obtained monthly from July through November to cover the period of maximum stratification. Readings were taken by

thermistor thermometer and oxygen-electrode meters calibrated by occasional samples titrated by the standard Winkler method.

The vertical profiles of water temperature and dissolved oxygen obtained during the late summer and fall of 1979 indicated some thermal stratification and a moderate loss of dissolved oxygen below a depth of 13.7 m (45 ft) by September (Table 20). At no time, however, was there a combination of high temperature and low oxygen sufficient to create conditions unsuitable for trout in the lake. At the peak of the hypolimnetic oxygen deficit in September, surface waters had already cooled sufficiently to make this stratum suitable for trout.

The poor development of thermal stratification and small hypolimnetic oxygen deficit in 1979 may have been an unusual case because of cool, rainy weather during the normally hot part of the summer. For this reason, a more typical year (1972) was selected from survey data collected previously by the CE for comparison. In 1972, surface waters reached 25 degrees C (77 degrees F) by July 25, with a strong thermocline starting at the 3 m (10 ft) depth. By September 19, dissolved oxygen almost completely disappeared below 12 m (40 ft) (Table 21).

A further comparison between the 1972 and 1979 data provided by Table 22 indicated that operation of the Seneca pumped-storage facility at the dam (not operating in 1972) possibly was responsible for increasing dissolved oxygen levels in the hypolimnion at least as far upstream as Sugar Bay, a distance of about 8 km (5 mi).

Table 20. -- Allegheny Lake. Temperature and dissolved oxygen profiles at mouth of Sugar Bay during the summer and fall of 1979 (T = temperature F; DO = dissolved oxygen in ppm)

Depth in feet	Date									
	13 Jul		21 Aug		21 Sep		17 Oct		12 Nov	
	T	DO	T	DO	T	DO	T	DO	T	DO
0	72.0	8.9	69.2	9.4	64.8	7.0	55.8	7.5	49.1	9.9
5	70.9	9.2	68.0	9.1	64.8	7.0	55.8	7.3	49.1	9.2
10	66.6	9.4	66.6	8.5	64.6	6.8	55.8	7.4	49.1	9.2
15	63.1	7.9	66.4	7.9	64.6	6.8	55.8	7.3	49.1	8.9
20	61.3	8.3	66.2	6.5	64.6	6.9	55.8	7.3	49.1	8.8
25	60.4	7.4	64.6	6.2	64.6	6.7	55.8	7.3	49.1	8.8
30	59.4	7.6	64.0	5.6	64.6	6.9	55.8	7.3	49.1	8.8
35	58.6	7.7	62.8	4.7	64.6	6.6	55.8	7.3	48.2	8.9
40	57.6	7.5	62.4	5.1	64.6	6.6	55.8	7.3	48.2	8.8
45	57.2	7.4	61.2	4.8	64.4	5.1	55.4	7.6	48.2	8.8
50	56.7	7.3	60.8	4.4	63.7	3.3	54.5	7.8	48.2	8.8
55	55.6	7.3	60.6	4.0	63.3	3.0	54.0	7.1	48.2	8.8
60	54.9	7.0	59.6	3.9	63.3	2.9	53.8	7.2	48.2	8.8
65	54.0	6.8	59.4	3.6	63.0	2.7	53.6	7.3	46.4	8.6
70	53.6	6.8	58.1	3.0	62.6	1.7	53.2	7.4	46.4	7.0
75	53.2	6.6	57.2	1.9	61.7	1.0	50.4	8.2	--	--
80	51.8	6.2	55.4	1.4	61.2	0.3	50.0	0.7	--	--

Table 21. -- Allegheny Lake. Temperature and dissolved oxygen profiles at mouth of Sugar Bay in 1972; data extracted from Corps of Engineers surveys (T = temperature F; DO = dissolved oxygen in ppm)

Depth in Feet	Date								
	13 Jun	11 Jul	25 Jul	21 Aug	19 Sep	5 Oct			
	T	T	DO	T	DO	DO			
0	61.7	72.5	76.6 7.7	73.4	66.4 6.9	62.6 6.0			
5	61.0	66.2	76.8 7.7	72.7	66.4 6.8	62.6 6.0			
10	60.8	64.6	76.1 7.5	70.9	66.4 6.8	62.6 5.9			
15	60.4	64.4	71.6 6.0	69.8	66.4 6.7	62.6 5.8			
20	59.7	64.0	68.4 4.8	68.4	66.4 6.7	62.6 5.8			
25	59.2	63.5	66.2 5.0	67.1	66.4 6.7	62.6 5.7			
30	58.1	63.0	65.3 4.8	66.2	66.4 6.6	62.4 5.8			
35	56.8	61.9	64.0 4.6	64.6	66.4 6.3	62.4 5.9			
40	55.6	60.8	63.0 4.0	64.0	65.7 4.1	62.4 5.9			
45	54.5	59.5	61.7 4.0	63.7	63.7 0.6	62.4 5.9			
50	52.9	59.0	61.3 3.8	63.1	63.0 0.6	62.2 6.1			
55	51.8	58.6	60.8 3.6	63.0	63.0 0.6	62.2 5.8			
60	50.2	57.6	60.4 3.4	62.6	62.6 0.5	62.1 5.1			
65	49.5	57.4	59.4 3.1	62.2	62.6 0.1	62.0 5.4			
70	48.4	57.2	69.2 3.0	62.2	61.2 0.0	61.7 6.2			
75	48.2	56.3	58.5 3.2	62.0	60.8 0.0	61.5 6.2			
80	46.9	56.8	57.6 3.3	60.4	60.1 0.0	61.3 5.3			
85	45.7	56.3	57.2 3.2	58.8	59.2 0.0	59.9 0.2			
90	45.0	55.9	56.8 2.5	57.6	58.8 0.0	-- --			
95	44.6	55.2	55.8 1.0	--	-- --	-- --			

Table 22. -- Allegheny Lake. Comparison of dissolved oxygen profiles obtained at mouth of Sugar Bay during the period of maximum stratification in 1972 and 1979. (DO = dissolved oxygen in ppm)

Depth in feet	July*		September*	
	1972	1979	1972	1979
0	7.7	8.9	6.9	7.0
10	7.5	9.4	6.8	6.8
15	6.0	7.9	6.7	6.8
20	4.8	8.3	6.7	6.9
25	5.0	7.4	6.7	6.7
30	4.8	7.6	6.6	6.9
35	4.6	7.7	6.3	6.6
40	4.0	7.5	4.1	6.6
45	4.0	7.4	0.6	5.1
50	3.8	7.3	0.6	3.3
55	3.6	7.3	0.6	3.0
60	3.4	7.0	0.5	2.9
65	3.1	6.8	0.1	2.7
70	3.0	6.8	0.0	1.7
75	3.2	6.6	0.0	1.0
80	3.3	6.2	0.0	1.3

The additional oxygen in the hypolimnion in the summer may be influencing vertical fish distribution in the lower sector of the lake by extending the cool-water living space for both trout and walleye.

A few other water quality parameters have been sampled by the CE at different times in the past. These show the water in the reservoir to be nearly neutral in pH and relatively soft. The range of values for 10 samples taken from different parts of the reservoir during the two days, 25-26 August, 1971, were as follows: pH, 6.5 to 7.2; specific conductivity, 140-180 reciprocal megohms; total alkalinity, 23-34 ppm; and hardness, 28-77 ppm.

Post-impoundment water quality considerations in the Allegheny River tailwater below Kinzua Dam were evaluated in the PFC study conducted between 1969-1974 (22). Alkalinity, hardness, dissolved oxygen, and pH were analyzed bi-weekly from June through November in 1970 and on a monthly basis in 1973 and 1974 at 15 representative stations extending approximately 161 km (100 mi) below Kinzua Dam. Total alkalinity, total hardness and conductivity were determined with a Mach DE-EL field kit, and dissolved oxygen was determined with a YSI dissolved oxygen meter. A Hellige hydrogen-ion comparator was used to determine pH. Dissolved oxygen values were generally adequate for optimum fish production at all stations throughout the period of analysis. Alkalinity and hardness determinations immediately below the dam ranged from an average of 26 to 35 ppm and 29 to 45 ppm, respectively. Values at the lower most

station (near Oil City, Pennsylvania) were only slightly higher, with the range in alkalinity averaging 33 to 53 ppm and 39 to 64 ppm for hardness. The pH values registered immediately below the dam ranged from 7.0 to 7.4 as compared to a range of 7.3 to 8.1 at the lower most stations.

Conductivity measurements were obtained only in November, 1974. Conductivity measured 170 reciprocal megohms immediately below the dam and 150 at the lower most station. The findings were summarized in the PFC report (22), as follows:

In reviewing these parameters, it is found dissolved oxygen levels are satisfactory at all stations. Alkalinity and hardness are rather consistent in range on a month-to-month basis. Throughout the sampling period, alkalinity and hardness generally ranged between 20 and 60 ppm in the Allegheny River.

The three major tributaries monitored have higher alkalinities and pH's than the Allegheny River. The pH's recorded at these stations are exceptionally high and appear to be the result of erratic pollution occurring on these streams. Future monitoring of these tributaries could pinpoint some of the pollution sources on these tributaries.

The overall effect these tributaries have on the Allegheny River appears to be minimal because of the regulated flows from Kinzua Dam...

The water quality of the study area is acceptable for a warmwater fishery throughout its entire length. The area immediately downstream from Kinzua Dam (six miles) provided a quality fishery for large brown and rainbow trout. The limiting factor downstream from this area is related to temperature rather than to general water quality.

Water quality does not appear to be a limiting factor in the life cycles of warmwater fishes present in the Allegheny River.

Several investigations have been conducted to examine the effects of the project on water temperature in the Allegheny River tailwater. A February, 1975 CE report, authored by G. R. Drummond and D. L. Robey, noted that the temperature of the Allegheny River under natural conditions could be expected to reach a sustained temperature of 15.5 degrees C (60 degrees F), or above, by the first of June (23). However, considerable temperature fluctuation could be anticipated annually (op. cit.), viz:

During the spring of most years, natural stream temperatures reach 60 degrees F for a short period of time (1-3 days), then drop below 60 degrees F before warming. The time from then to sustained 60 degrees F averages between 15 and 20 days... There is close agreement between the average, earliest, and latest dates to reach 60 degrees F on the harmonic curve, and the time to a sustained 60 degrees F on the computed data. From the above analysis, it can be said that, on the average, a sustained 60 degrees F can be expected under natural conditions by the first of June. But, there is also the possibility that a sustained 60 degrees F can be reached as early as mid-May or as late as the second week of June based upon the sixteen years of data.

Also, the PFC tailwater investigation pointed out that the construction of operation of the Allegheny Lake project had effected a temporal change in the temperature regime of the Allegheny River below the Kinzua Dam (22), viz:

A temperature lag occurs in the spring and fall of each year, and daily high temperatures are lower than those recorded during the preimpoundment era. January, February, and March temperatures appear to be comparable to those of the preimpoundment era.

This theme was expanded in a report titled "The Effect of Kinzua Dam on

Water Temperature and Aquatic Life," published by the CE in 1975 (24),

viz:

The average annual temperature of the Allegheny River directly below the site of Kinzua Dam has dropped from 50.6 degrees F. to only 50.0 degrees F. since the start of operations at Kinzua Dam in February, 1967 (from 50.2 degrees F. to 49.5 degrees F. using Glade Run Bridge data). However, the seasonal temperature pattern of the river below Kinzua Dam has changed significantly more than what is reflected by the pre-impoundment and post-impoundment average yearly temperatures. The overall effects of the dam have been to create colder spring temperatures, delay and lower maximum summer temperatures and to warm the river into the fall and winter... Whereas July temperatures at Glade Run Bridge, 6.9 river miles downstream of the dam, averaged in excess of 72 degrees F. and reached maximums of over 76 degrees F. yearly before impoundment, summer temperatures greater than 72 degrees F. at Glade Run Bridge are now uncommon.

Comparison of Glade Run Bridge temperature data with temperature measurements taken directly at the dam show little summer warming in this seven mile section of the river. However, in the River directly below Warren, Pennsylvania, warming in summer is extremely rapid and by Irvine Bridge (15.8 river miles downstream of the dam) the maximum mean monthly river water temperature exceeds the maximum mean monthly inflow temperature of the reservoir measured at Salamanca, New York. In August, the month of warmest water temperature downstream of Kinzua Dam, the river is warmed at a rate of 0.2 degrees F./mile from the outflow to Irvine Bridge, the next downstream station for which a good temperature record is available. Practically none of this warming occurs above Glade Run Bridge, but averages 0.5 degrees F./mile in the section from Glade Run Bridge to Irvine Bridge. To our knowledge, no pre-impoundment data for Irvine Bridge is available, but by extra-population of data from other stations upstream and downstream of Irvine Bridge..., it appears that maximum mean monthly river temperature now approach to within 0.8 degrees F. of natural pre-impoundment temperatures, although these summer maximums are delayed one to three weeks.

Also, the operation of the Seneca pumped-storage power facility was expected to further exacerbate the lower than desired temperature of water released in the Allegheny River tailwater below the dam. However, temperature studies conducted by the Waterways Experiment Station, Corps of Engineers concluded that the operation of the pumped-storage facility was not responsible for lowering the temperature of water released from the Allegheny Lake project (25), viz:

Pumped-storage actually causes the hypolimnion to warm faster without any significant cooling of the epilimnion.

Angler use

The earliest available angler survey data from Allegheny Lake were collected in conjunction with a boating use survey conducted by the USFS between May 30 and September 30, 1969 (26). Data were obtained on ten randomly selected sample days, five of which were weekdays and five weekends or holidays. Information came from three sources. Traffic counters recorded the number of vehicles entering or leaving major recreation areas around the reservoir. This was backed up by water meter readings in two recreation areas to help determine the number of people using the facility. Aerial observation of the number, kind of boats and activity were made on five different one-hour flights spread through the sample day. Finally, USFS personnel interviewed departing boaters at four boat launching sites to determine information on numbers in the party, point of origin, and hours engaged in various activities.

A total of 37,202 visitor days were estimated over the 4-month tourist season. Fishing accounted for 8,183 days (22 percent) of the total visitor day use, which was equivalent to 98,196 hours @ the 12 hours/visitor day value utilized by the USFS in the study. A ground-truth sample of 452 boats revealed the following statistics.

- (1) 101 (22.3 percent) of the 452 boats were used in fishing.
- (2) One or more fish were caught in 32 of the 101 boats that were used in fishing.
- (3) It took 784 hours to catch 186 fish at the rate of 0.24 fish per hour.
- (4) Yellow perch (83), smallmouth bass (27), white crappie (24), black crappie (20), and the carp (15) made up 91% of the total catch. No muskellunge, northern pike, brown trout or walleye were reported in the catch.

Estimates of fishing pressure (expressed as the number of "visitor-days") were made annually by the USFS from 1970 through 1980 in conjunction with collection of overall recreational use statistics under the Forest Service Information Management (RIM) program. Each "visitor day" as defined by the USFS, represented 12 hours of use on the project. The number of visitor days reported by the USFS was converted to equivalent fishing man-days on the basis of the average amount of time actually spent fishing as determined by the creel survey conducted by the PSU in 1979-1980 (21).

Both categories of "warmwater fishing" and "ice fishing" listed in the RIM annual computer printouts reflect fishing estimates pertinent to Allegheny Lake. The "coldwater fishing" category refers to estimates

of fishing use on tributary trout streams within the project impact area. (Russell Hill, Allegheny National Forest, USFS, pers. Comm., 1981).

Average annual warmwater angling man-day use on Allegheny Lake was estimated at approximately 166,700 man-days from 1970 through 1980 (Table 23). Ice fishing man-days use accounted for an additional 1,500 man-day per year. Trout fishing on tributary streams was estimated at some 77,100 man-days per year.

The portion of Allegheny Lake located in New York lies almost entirely within the Allegany Indian Reservation, and a special fishing license issued by the Seneca Indian Nation is required to fish in this sector of the lake. As noted previously in Table 8, a total of 7,575 fishing licenses were sold to non-Indians during the 1979-1980 fishing season. An additional 122 fishing licenses and 112 combination fishing and hunting licenses were sold to residents of the reservation. Although data concerning the number of fishing man-days use was not available, angler use evidently was significant based on the total of 7,809 fishing licenses sold to both Indians and non-Indians.

An intense creel survey of Allegheny Lake was conducted between April 1, 1979 and March 31, 1980 by the project subcontractor. The following methodology was employed for the study (21), viz:

A sampling schedule was designed separately for three time periods, each of which estimated fishing pressure, yields, and catch rate. Intuitively, we expected that seasonal differences existed in composition of anglers, their catch rate, and species composition of the catch.

Table 23. -- Allegheny Lake Project. Estimates of annual fishing pressure (expressed in thousands of days) recorded within the Allegheny Reservoir Recreation Area managed by the U.S. Forest Service. Data concerning visitor-day use (12 hours/day) derived from annual RIM estimates compiled by the U.S. Forest Service. "Warmwater" and "ice fishing" estimates apply to Allegheny Lake. "Cold water" estimates refer to tributary trout streams within project impact area

Year	Warmwater		Ice fishing		Cold water	
	No. visitor days	No.* man-days	No. visitor days	No.* man-days	No. visitor days	No.* man-days
1970	28.0	65.8	--	--	19.4	62.8
1971	61.6	144.8	--	--	7.3	23.7
1972	65.3	153.5	--	--	8.5	27.5
1973	68.0	159.8	0.6	1.2	13.0	42.1
1974	71.9	169.0	0.5	1.0	29.0	77.8
1975	68.2	160.3	0.7	1.4	14.3	46.3
1976	77.5	182.1	0.7	1.4	47.1	152.6
1977	75.5	177.4	0.9	1.8	47.0	152.6
1978	81.5	191.5	0.9	1.8	23.3	75.5
1979	85.2	200.2	0.9	1.8	25.4	82.3
1980	97.8	229.8	0.7	1.4	27.1	87.8
Average	71.0	166.7	0.7	1.5	23.8	77.1

* Number of man-days computed as follows: warmwater fishing trips were based on average trip length of 5.1 hours as registered in PSU creel survey for the spring and summer period; ice fishing on average trip length of 6.6 hours as registered in PSU creel survey for ice fishing; and cold water trip length based on average of 3.7 hrs/trip as estimated by the USFS.

A stratified design for separate time periods permitted a better statistical predictability of the extrapolated estimates. The data base included counts of all users on pre-designated segments of the reservoir. Personal interviews of large numbers of anglers at access areas yielded data on catch rate and species composition of the catch.

For each interview we determined the number of actual fishermen in the party, the number of hours fished, and the number and species composition of the catch.

For each boat count during the spring-summer and fall census periods, a trip was made by motorboat around the perimeter of either the main arm or the Kinzua arm to count the number of boats in use on that day. Data were tallied as to type of craft, the number of individuals on board, and the number of fishing rods in use. This information distinguished angling use from other recreational uses of the reservoir, and established the total of fishing pressure.

The detailed schedule for creel census and angler-counts follows: It was hoped that the day to day variability in the data would permit an estimate of fishing pressure with confidence limits of $\pm 20\%$, but our sampling effort was determined more by budget restrictions than by statistical reliability of the estimates. A minor change in the original schedule for the winter census was necessary because of the delayed formation of safe ices.

- (a) Schedule of Creel Census - Allegheny Reservoir
(After specified dates, M = boat count days on main arm of reservoir; K = boat count days on Kinzua arm of reservoir)

Spring and Summer Census

April 14M, 15K, 16M, 17K
May 4M, 5K, 6K, 7, 16, 17M, 18K, 19, 24, 25M, 26M, 27K
June 10, 11M, 12K, 13M, 21M, 22, 23M, 24K
July 2, 3K, 4M, 5K, 6M, 7K, 8, 9K, 17K, 18M, 19, 20
August 6M, 7K, 8, 9K, 21M, 22, 23M, 24K, 31K
September 1M, 2M, 3K

Fall Census

September 19M, 20, 21K, 22, 28K, 29M, 30K

October 1M, 9M, 10K, 11M, 12, 21M, 22K, 23, 24M

November 3M, 4, 5, 6K, 22K, 23M, 24K, 25K

Winter Census

January 18, 19, 20, 21, 22M, 23K, 24M, 25K

February 9M, 10K, 11M, 26K, 27M, 28K

- (b) Summary of Creel Census Schedule, Allegheny Reservoir Spring and Summer census (SS, 1 April - 15 September, 1979) Fall census (F), 16 September - 31 December, 1979 Winter census (W), 1 January - 31 March, 1980

Period	Days of the week							
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total

Number of census days

SS	7	7	6	7	7	8	6	48
F	4	4	3	3	3	3	4	24
W	2	2	2	2	2	2	2	14

Boat counts on main arm of reservoir

SS	2	2	2	3	3	3	3	18
F	1	1	1	2	1	1	2	9
W*	1	1	1	1	1	1	1	7

Boat counts of Kinzua arm of reservoir

SS	3	3	4	1	2	3	1	18
F	2	1	1	1	1	2	1	9
W*	1	1	1	1	1	1	1	7

* Either fisherman counts on the ice, or vehicle counts at parking areas; whichever is most practical.

Findings from the PSU conducted creel survey were as follows, (op. cit.):

In designing the sampling schedule, we anticipated that more anglers could visit the lake during spring and summer than at other times of the year. Consequently, we allotted more sampling days during this period. This assumption was correct; 71% of the

angling occurred in the 144-day period of April through August. Fishing pressure was lightest in the 124-day fall period (14%) and picked up somewhat during the short 68-day winter period (15%).

The total fishing pressure on the reservoir for the year was established (from expansion of our sampling days) to be 19,642 angler days [Table 24]. This was about half of the total persons using the lake for water-based recreation. A total of 13,503 boat-days was estimated for the year, most of which occurred during the spring and summer period.

Anglers kept 22,498 fish at an average catch rate of 0.24 fish per hour, with ice fishing being the most rewarding at a rate of 0.35 fish per hour...

On an overall basis, yellow perch were most numerous in the catch (50%), although they were seldom fished for or caught in the fall [Table 25]. Walleyes were second in abundance (28%), followed by smallmouth bass (7%). [Black and white crappie made up approximately five percent of the total harvest and rock bass approximately four percent]. Brown trout, northern pike and muskellunge made up an insignificant portion of the catch (total of 3.3%) but, because of their large size, were highly prized by anglers. [Additional species taken by anglers included rainbow trout, carp, brown bullhead, largemouth bass and white bass]...

The total harvest of fishes from the reservoir in 1979 was very low based on either number or weight. We estimated the total weight of the 22,498 fish kept by anglers to be approximately 31,000 pounds [14,062 kg], which is equivalent to a harvest rate of 1.9 fish or 2.6 pounds per acre [2.9 kg/ha] from this 12,050 acre [4,876 ha] reservoir. Part of this low harvest is due to the 15-inch [38.1 cm] minimum size limit on the walleye results in much of the catch by anglers being undersize. From his creel census interviews with anglers, Charles C. Wagner estimates the following ratios of legal:sub-legal walleye being caught; spring season, 1 legal:18-25 sub-legals; summer and fall seasons, 1 legal:12-15 sub-legals; winter ice season, 1 legal:407 sub-legals.

The winter fishery appears to more nearly match the ratio of legal to sub-legal walleyes taken in the reservoir by gill netting in 1979. If the size-frequency

Table 24. -- Allegheny Lake. Summary of creel survey statistics, 1979-1980 fishing season (21)

Item	Sampling period			
	Spring and summer	Fall	Winter	Total
<u>Empirical</u>				
No. days in period	144	124	68	336
No. days sampled	48	24	14	86
No. anglers interviewed	1,318	261	289	1,868
% successful anglers	36	32	62	39
No. fish harvested	1,222	144	680	2,046
No. fish harvested/hour	0.200	0.158	0.352	0.237
Range in catch/hour	0.0-0.95	0.0-0.64	0.07-1.04	0.0-1.04
<u>Expanded</u>				
<u>No. anglers (Total)</u>	14,146	2,660	2,836*	19,642*
Boat	10,894	2,378	--	13,272
Shore	3,252	282	--	3,534
<u>Hours fished (Total)</u>	72,195	9,222	18,756	94,928
Hours ha	14.8	1.9	3.8	19.5
Hours ac	6.0	0.8	1.6	7.9
Hours fish/angler	5.1	3.9	6.6	4.8
<u>No. fish harvested (Total)</u>	14,439	1,457	6,602	22,498
No./ha				4.6
No./ac				1.9
<u>Estimated weight harvested</u>				
Kg				14,209
Lbs				31,326
Kg/ha				2.9
Lb/ac				2.6

* Includes ice fishermen

Table 25. -- Allegheny Lake. Expanded estimates of species composition of the catch for the 1979-1980 fishing season

Species	Sampling period							
	Spring and summer		Fall		Winter		Total	
	No.	%	No.	%	No.	%	No.	%
Yellow perch	5,868	40.6	172	11.8	5,240	79	11,280	50.1
Walleye	4,211	29.2	992	68.1	1,040	15.8	6,243	27.7
Smallmouth bass	1,433	9.9	203	13.9	0		1,636	7.3
Rock bass	834	5.8	20	1.4	0		854	3.8
White crappie	673	4.7	0		10	0.2	683	3.0
Black crappie	411	2.8	0		0		411	1.8
Northern pike	212	1.5	30	2.1	97	1.5	339	1.5
Channel catfish	249	1.7	0		78	1.2	327	1.5
Brown trout	162	1.1	30	2.1	117	1.8	309	1.4
Carp	162	1.1	0		10	0.2	172	0.8
Muskellunge	87	0.6	0		10	0.2	97	0.4
Rainbow trout	75	0.5	0		0		75	0.3
Brown bullhead	50	0.3	0		0		50	0.2
Largemouth bass	12	0.1	0		0		12	tr.
White bass	0		10	0.7	0		10	tr.
Total	14,439		1,457		6,602		22,498	

tr. - Less than 0.1 percent

data in Table [16] can be accepted as being representative of the walleye population in the reservoir, anglers catch a greater proportion of sub-legal than legal walleyes.

The fishery can best be characterized as producing a few, large, trophy fish (walleye, brown trout, northern pike, muskellunge, and channel catfish) at a very low total harvest rate from the reservoir. Such a condition may be considered to be ideal for a few talented or lucky fishermen, but it probably contributes to a low total interest in the majority of persons who might wish to use the reservoir for fishing. Except for the yellow perch and a few crappie, this fishery is notable in not producing hardly any of the usually abundant game and panfishes in reservoirs such as largemouth bass, blue gills and bullheads.

There is one exception to this generalization. At local campgrounds, many small rock bass are kept by bank fishermen, predominantly juvenile and mothers. These seldom show up in the catch statistics because of the short, intermittent time periods spend fishing. But, pan-fishing derbies held in camp grounds attract many juveniles and account for a sizeable catch.

It is interesting to compare the 1979 catch data with projections made by Jenkins in 1973 for this reservoir [27]. Based on his model derived from many reservoirs and incorporating data such as morphology, water chemistry, and reservoir age, the Allegheny Reservoir should now have an annual sport fishing harvest of about 15.0 pounds per acre, or approximately 0.50 pounds [0.23kg] of fish harvested per hour of fishing. Our estimates for these values were 2.6 pounds per acre [2.9 kg/ha] and 0.33 pounds [0.15 kg] per hour, respectively. This is another indication that the catch in Allegheny Reservoir is biased toward a few trophy fish taken by a small number of anglers.

Further analysis of the creel survey data collected during the 1979-1980

PSU conducted creel survey indicates that the walleye fishing success

rate was exceptionally high. A total of 6,243 walleye \geq 38.1 cm (15 in), amounting to some 28 percent of the total number of all species harvested, were captured at a rate of 0.07 fish per hour. Including the large number of sub-legal walleye caught and released, the overall catch rate for walleye would have been well over 0.7 walleye/hour. This high catch rate is particularly significant in view of estimated loss of some 60,000 walleye from the lake during the winter of 1978-1979, as reported by the FWS (28), viz:

Each year, from mid-October to late April, large numbers of walleye, as well as other fishes, are discharged from the reservoir through the lower sluices. These fish suffer explosive decompression by being displaced from as deep as 120 feet instantaneously to surface levels below the dam. This walleye loss during the winter of 1978-1979 exceeded 60,000 fish.

The loss of walleye discharged through the lower sluices of Kinsua Dam during the winter has subsequently been reduced by an estimated 75 percent by action taken by the CE to maintain the lake level around elevation 399 m (1,310 ft) through January, instead of a more rapid draw-down to elevation 393 m (1,288 ft) by November, as practiced in previous years (John K. Anderson, Fisheries Biologist, FWS, pers. comm., 1981).

Fishing success for smallmouth bass in Allegheny Reservoir, on the other hand, has apparently declined somewhat over time, although remaining high enough to attract bass fishing tournaments, (21), viz:

Two bass tournaments (one for 1 day, another for 2 days) were conducted during the summer of 1979 on Allegheny Reservoir. Even though these anglers

released all of their catch after the fish were measured and weighed by tournament officials, we felt that a summary of these data would be useful in comparing catch rates in other situations. Only smallmouth bass were caught in this tournament since largemouth bass are almost non-existent in Allegheny Reservoir.

A comparison of the catch rates of smallmouth bass recorded in the bass tournaments with the 1969 USFS creel survey and 1979-1980 PSU creel survey is presented in Table 26.

The post-impoundment angling use as estimated from the 1979-1980 PSU creel survey (19,642 angling man-days) was much lower than the average annual estimates derived from the USFS RIM computer printouts (168,200 angling man-days). The USFS estimates were based on a minimum of hard data, relying primarily on information provided by traffic counters placed at major recreation areas around the lake, as contrasted to the carefully designed and executed creel survey conducted on Allegheny Lake by PSU.

However, the angling pressure reflected by the 1979-1980 PSU creel of only 4 man-days/ha (1.6 ac) appeared to be unusually low. A large number of individuals with intimate, daily contact with the Allegheny Lake fishery including the CE Resource Manager for the lake, the FWS resident fishery specialist, and the PFC regional fisheries manager were convinced that the low fishing pressure in the 1979-1980 fishing season was atypical. They attributed the low recorded angling use in the 1979-1980 fishing season to reduced travel occasioned by the severe gasoline

Table 26. -- Allegheny Reservoir. Comparison of smallmouth bass catch rates in two bass fishing tournaments conducted in the summer of 1979 with smallmouth bass catch rates in the 1969 USFS creel survey and the 1979-80 PSU creel survey. Fish tallied and released in the bass tournaments were ≥ 30.5 cm (12 in) with an average weight of 0.86 kg (1.9 lbs). Smallmouth bass in the 1969 and 1979-80 surveys represented harvested fish exceeding the ≥ 22.9 cm (9 in) minimum size limit

	1979 bass tournament	1969 USFS boating study*	1979 PSU creel survey**
No. anglers	144	19,254	14,146
No. hours fished	1,692	98,196	72,195
No. smallmouth bass caught	82	3,382	1,433
No. bass/hour	0.048	0.034	0.02

* Estimates expanded from data collected between May 30 to September 30, 1969.

** Estimates expanded from data collected between April 1 to September 30, 1979.

shortage which developed early in 1979 and to the concurrent wet and cooler than normal summer weather.

The report of the PSU subcontractor addresses this contingency, as follows (21):

Although we have no firm data to judge the effect of gasoline shortages and rainy weather on total use, one can safely assume that they contributed in some degree to a less-than-normal use for 1979. However, it is not all likely that this accounts for the large difference between projected angler use of 120,500 days and our 1979 estimate of 19,642 days.

Although comprehensive post-impoundment creel surveys have not been conducted on the Allegheny River tailwater, periodic angler counts were made in the tailwater immediately below Kinzua Dam by PFC Waterway Patrolmen during the spring and fall of 1978. The PFC estimated that some 6,000 man-days of fishing occurred in the 1.2 km (0.75 mi) stretch of the Allegheny River below Kinzua Dam during this period (Richard Snyder, Chief, Fisheries Management, PFC, pers. comm., 1981).

Also, PFC Waterway Patrolmen estimated in 1974 that the first 10 km (6 mi) of the Allegheny River below Kinzua Dam supported approximately 30,000 man-days of angling annually. The Allegheny River downstream from Irving, Pennsylvania to Franklin, Pennsylvania [some 134 km (85 mi)] supported an estimated 100,000 angling man-days per year.

Also, the PFC's qualitative assessments of the post-impoundment recreational fishery in the Allegheny River tailwater indicate that the

recreational fishery below the Kinzua Dam particularly in the winter and spring months, is of high quality (22), viz:

The present fishery in the Kinzua tailrace is an exceptional one. High angler success for walleye occurs from early November until the season goes out in mid-March. This may be the result of walleye upstream migration and a "piling up" effect at the dam. During the 1972 Tidioute Fishing Tournament, 7 legal muskellunge were reported during a 38 hour period.

An excellent trophy size brown trout fishery has developed at the tailrace. A one day catch by one angler of eight 20 inch plus trout was a factor in setting up a year around, 3 per day, trout fishery for 0.75 mile below the dam. A school of rainbow trout ranging from 17 to 19 inches was encountered during an electroshocking survey in 1973, and over 150 brown trout were removed from a coffer dam at the base of Kinzua during repair work in 1975.

In addition to walleye, muskellunge and trout, small-mouth bass are present in the tailrace fishery; however, they do not contribute to the fishery as much as the three previously mentioned species.

As a consequent of the excellent mix of warmwater and coldwater species entering the fishery, the PFC was opposed to any change in the temperature regime in the tailwater (op. cit), viz:

The above factors point out that a trout-warmwater fishery can coexist in the tailrace area. This is an important factor since several individuals and groups have pushed for a bottom drawoff and establishment of a trout fishery in the Upper Allegheny River. Creation of a trout fishery in the Upper Allegheny would not be a program beneficial to anglers who fish in the northwest area of Pennsylvania. Creation of a trout fishery is opposed for the following reasons:

1. At the present time a high quality trophy trout fishery exists. This quality fishery is based on the size of trout rather than the numbers of trout present in the tailrace area.

Within a 25 mile radius of the Kinzua tailrace there are approximately 39 streams and 1 lake presently being stocked by the Pennsylvania Fish Commission and the U.S. Fish and Wildlife Service. Cooperative nurseries stock several additional streams within the 25 mile radius. There are also in excess of 150 streams which support native brook and brown trout populations in this area.

2. A bottom drawoff would create cold water for several miles downstream and undoubtedly provide the needs for trout; however, a bottom drawoff would also create marginal water for an additional number of miles downstream between suitable trout and bass water. This would only be moving a problem of marginal water downstream and draw considerable criticism from warmwater anglers.
3. In order to provide enough trout to get a return to the average angler, very large numbers of trout would have to be stocked. The management of such a large put-and-take trout fishery would undoubtedly result in very low returns for a very high investment.

Fishery Resources -- Discussion of Planning Input

The FWS served as the lead agency responsible for coordinating fishery resource planning efforts for the Allegheny Lake project. Project planning was complicated considerably by the unusually large number and diversity of agencies and organizations which become involved in the planning process.

In addition to the two state agencies (NYDC and PFC) with primary stewardship responsibilities for the fisheries resources of this interstate project, the Seneca Nation of Indians also was directly involved as almost all of the project waters in the New York sector were located within the Allegany Indian Reservation.

Among the several federal agencies concerned with project planning other than the FWS and CE, the USFS played a particularly important role as the principal proprietor of lands and waters located within and adjacent to the project impact area. The National Park Service also was involved transiently over the brief period that consideration was given to the establishment of the project areas as a National Recreation Area to be planned, developed and administered by the National Park Service.

The Bureau of Indian Affairs represented the interests of the Seneca Indian Nation on the federal level, particularly in relation to the subsequently successful efforts made to establish the legitimacy of the Indians rights to control and manage the fishery resources on waters located within the Allegany Indian Reservation associated with project

development.

Involvement of the National Power Commission and two private utility companies occurred during the latter stages of project planning as a result of the successful application by the Pennsylvania Electric Company and the Cleveland Electric Illuminating Company for a permit to construct a pumped-storage power facility (Seneca Pumped-Storage Hydro Electric Generation Station) to be operated in conjunction with the Allegheny Lake project.

A review of the documents and correspondence associated with the Allegheny Lake project indicated the FWS made every effort to fully coordinate fishery resource planning with these many agencies and organizations with an interest in the project. Project coordination activities by the FWS extended well beyond the submission of the May 9, 1961 final FWS report.

For example, one of the most significant events affecting project fishery resources in the interim period between the submission of the May 9, 1961 FWS reports and impoundment of the lake in 1966, was the development of the 400,000 kilowatt Seneca Pumped-Storage Hydro Electric Generating Station, an integral component of the Allegheny Lake project. An application for license of the project was filed jointly by the Cleveland Electric Illuminating Company and the Pennsylvania Electric Company on May 26, 1964. A license authorizing construction of the project was issued by the Federal Power Commission (FPC) on December 28, 1965 (29).

Construction of the facility was initiated in April, 1965 and electric power generation began in December, 1972.

During the early stages of negotiations for the issuance of an operating license for the facility, the FWS played an active role in coordinating efforts to protect fishery resources affected by the project. A letter dated September 10, 1964, from the Regional Supervisor, Branch of River Basin Studies (FWS) to the Acting Executive Director of the PFC outlined several problem areas expected to develop with the construction of the pumped-storage facility (30), viz:

...The problems posed by this project are its possible effects on the federal fish hatchery to be constructed a short distance below Allegheny Reservoir and on the trout fishery to be developed downstream from the dam. There is a slight possibility that flows discharged from the power units into the main reservoir would be of such velocity as to cause excessive turbidity and, by preventing thermal stratification, eliminate any selection of warmer water, from the epilimnion or colder water from greater depths. These two conditions (turbidity and uniformly cold water) would adversely affect the hatchery's water supply and would be detrimental to maintaining a favorable downstream trout fishery. In addition, the downstream trout fishery could be adversely affected by the conventional power unit. Flows from the upper reservoir through this unit to the river would at times, entirely replace releases from Kinzua Dam. This could result in rapid changes in downstream temperatures that would be detrimental to fish.

Except for the danger of fish being drawn into the pump through the upper intakes, the project is not expected to significantly affect the reservoir fishery.

The development affords opportunities for the conservation of the fishery resources. There is a need for fish screens on the upper intakes in Allegheny

Reservoir. Maintaining optimum oxygen content and temperature in waters used by the hatchery and in the downstream fishery will depend on (1) selecting the best water intake level when pumping from the Allegheny Reservoir into the storage reservoir and the best discharge level when returning water to the lower reservoir from the storage reservoir, and (2) coordinating water releases from the storage reservoir directly into the river with operation of the Allegheny Reservoir sluiceways and spillways. Choices of intake and outlet levels will certainly vary with seasons and water temperatures. Weekly or even daily variations are possible. The best possible combinations under varying conditions cannot be determined until the project is operational.

Accordingly, we plan to request that the conditions in Form L-3 (revised November 1, 1963) relating to fish and wildlife and recreational resources be included in any license issued for this project, provided that, subsequent to approval of the final design drawings prior to commencement of construction, no modification of project structures in the interest of fish and wildlife resources which involves a change in the location, height, or main structure of a dam, or the addition of or changes in outlets at or through a dam, or a major change in generating units, or a re-arrangement or relocation of a powerhouse, or major changes in a spillway structure shall be required.

In addition to these L-3 conditions, we plan to request that fish screens be provided for the upper intakes in Allegheny Reservoir.

The concerns voiced by the FWS regarding possible adverse impacts on fisheries resources of the pumped-storage facility were reconciled in the December 28, 1965 FPC order issuing the license (29), viz:

The Department of the Interior by a series of letters, dated September 27, 1962, November 27, 1964, and July 7, 1965, recommended several special conditions for the protection and propagation of fish life in the Allegheny River Reservoir, and in the river below the reservoir. It appears that the

objectives of these recommended special conditions can be fully realized, however, under the provisions of Article 15 of attached Form L-6.

An order amending the project license to provide for installation of water intake structure screens to protect fishery resources was issued by the FPC, September 26, 1966 (31), as follows:

Article 60. Licenses shall during development of details of project design and during construction and operation cooperate with the Pennsylvania Fish Commission in the interest of protecting the fishery resources. In the event the licenses and the Fish Commission fail to reach agreement on facility design, including that of the water intake structure screens or racks, the Commission reserves the right to make such determination after notice and opportunity for hearing.

Two major documents were prepared by the FWS which described and evaluated various potential project impacts expected as a result of project implementation.

The first document, submitted to the CE in August, 1958 presented a comprehensive qualitative and quantitative appraisal of the fishery resources and current levels of angler utilization within the entire project impact area. These data were derived from information provided by well-designed and competently executed creel surveys and field investigations conducted in 1956 and 1957 by the FWS in cooperation with NYDC and FPC personnel.

No quantitative data predicting the size or monetary value of the post-project recreational fishery was provided. However, the August, 1958

FWS report contained an excellent appraisal of the changes in fishery habitat expected as a result of project construction. A series of recommendations designed to mitigate adverse impacts expected from project construction were included in the report.

Apparently assuming that these excellent recommendations provided by the August, 1958 FWS report would be implemented, the authors of the final May 9, 1961 FWS report omitted specific reference to these recommendations. The only fishery resource oriented recommendations contained in the May 9, 1961 FWS report were general recommendations that addressed standard institutional practices (6), viz:

1. That all agencies whose responsibilities for resource management relate them to the Allegheny River Reservoir project, including the New York Department of Conservation, Pennsylvania Game Commission, Pennsylvania Fish Commission, U.S. Forest Service, National Park Service, Seneca Indian Nation, this Bureau, and any other appropriate agencies or groups, meet to consider at the proper time a formulation of a reservoir land use plan under the coordinating leadership of the Corps of Engineers which will include, among other things; reservoir zoning for fishing, boating, and other uses; management of peripheral reservoir lands; development of adequate sites for fishing use in New York and Pennsylvania, supplementing those now planned by the Corps; stream temperatures to be maintained in river at the dam; additional public access to Allegheny River on right bank between Kinzua Dam and Tidioute; extended fishing seasons; reciprocal fishing license agreements; location and adequacy of access areas; and mitigation of habitat losses due to inundation.
2. That the 9 access sites in Pennsylvania now planned for development by the Corps of Engineers provide maximum facilities to park automobiles

and boat trailers, together with a commensurate number of launching ramps, so as to properly provide for the anticipated fishing use insofar as possible.

3. That reasonable additional modifications compatible with primary purposes of the project be made in project facilities or operations, subsequent to completion of construction, as may be desirable to obtain maximum over-all project benefits, on the basis of follow-up studies by this Bureau to improve or supplement measures taken for the conservation and development of fish and wildlife resources.

Also, in spite of the obviously intensive effort made by the FWS to touch bases with all concerned agencies and organization, it appeared that the authors of the May 9, 1961 FWS report ignored completely the wishes of the PFC regarding the type of tailwater fishery desired in the Allegheny River below the Kinzua Dam. Instead of supporting the PFC requests for a warmwater tailwater fishery, much of the body of the May 9, 1961 FWS letter report and appended substantiating report dealt with measures designed to provide for and/or justify a cold water (trout) fishery in the tailwater. The FWS report recommended that the temperature of water released from the project be intermediate between surface and bottom in order to provide cold water [12.8 degrees C. (55 degrees F.)] suitable for trout. The FWS report recommendation for construction of a National Fish Hatchery in conjunction with the project was intended primarily to provide trout for stocking the tailwater. Although this hatchery subsequently was constructed, none of the fish raised have been stocked in the tailwater. In fact, fish production from this facility has been

historically earmarked for distribution outside the project impact area.

The CE subsequently implemented post-project water discharge regimes designed to duplicate natural pre-project river temperature downstream in-so-far as possible. However, post-impoundment tailwater investigations revealed that temporal changes nevertheless have occurred in tailwater temperature regimes. Late spring and summer water temperatures have been lowered somewhat, while fall and early winter temperatures have increased over pre-project conditions. Little temperature change has been noted in late winter. Due to lower average summer tailwater temperature, the Allegheny River currently provides optimum temperatures for trout as far downstream as Warren, Pennsylvania, some 11 km (7 mi). Project effects on Allegheny River temperature are negligible below Irving, Pennsylvania which is located approximately 25 km (16 mi) below Kinzua Dam. No changes in other water quality parameters have been noted that would affect the recreational fishery.

Although no quantitative creel surveys have been conducted on the Allegheny River tailwater in post-impoundment years, estimates made by knowledgeable PFC and FWS personnel indicate that the tailwater in the 11 km (7 mi) stretch immediately below Kinzua Dam provides an excellent fishery. Trophy size brown trout, muskellunge and walleye are commonly creeled. Estimates of post-project angler man-day use in the immediate tailrace area have ranged from 6,000 to 30,000 man-days per year. Little change in post-project fishing pressure has been observed over the

remaining portion of the 105 km (65 mi) Allegheny River tailwater.

FWS predictions of post-project angler man-day use in Allegheny Lake have proven to be overly optimistic. The May 9, 1961 FWS final report predicted that the lake would provide a minimum of 120,500 man-days of angling per year if no access facilities were provided at the project, and some 300,000 man-days per year if special access facilities were constructed. In fact, however, the lakewide creel survey conducted by PBU from April 1, 1979 through March 30, 1980, indicated that Allegheny Lake supported less than 20,000 man-days of angling per year, or some 83 percent under the minimum FWS report prediction and/or some 93 percent under the maximum FWS report prediction.

Information is available which suggests that the 1979-80 fishing season was atypical because of critical gasoline shortages and an unusually cold and wet summer which inhibited fishing during the year. However, even with acceptance of the highly unlikely assumption that fishing pressure in the 1979-80 season was only half of normal, the May 9, 1961 FWS prediction of annual angler man-day use (300,000 man-days) appears to be grossly exaggerated.

It seems apparent that several other factors in addition to gasoline shortages and weather may have contributed to the lower than anticipated post-impoundment fishing pressure observed at Allegheny Lake. One such factor may have been the high priority (and apparently successful) management emphasis given to stocking predator species by the PFC. As

indicated both by the creel survey and lake fish population sampling, predator species, particularly walleye, were extremely abundant. In such a highly predator dominated fish community structure, the unusually abundant and more readily caught pan fish species (sun fishes and yellow perch) which normally support a great deal of angling pressure, are substantially depressed. In addition, the size composition of the walleye population in Allegheny Lake was heavily weighted towards smaller sub-legal size fish [\leq 38.1 cm (15 in)] which may well have further discouraged fishing participation.

Although the May 9, 1961 FWS report was not sufficiently detailed to determine the precise methodology employed for developing post-impoundment use projections, it was evident that the authors of the May 9, 1961 FWS report placed an inordinate emphasis on the large human population residing within the general vicinity of the project, viz:

Based on Bureau of Census population projections, it is estimated that 11,000,000 people, representing segments of the population of Pennsylvania, New York, Ohio and West Virginia, reside within comparatively easy driving distance of the area. Included in this group are approximately 770,000 licensed fisherman and about 260,000 unlicensed children and retired adults who fish. Depending upon the quality of the project fishery and the convenience of adequacy of access and day-use facilities, a large segment of these sportsmen are potential users of the newly-created fishery resources. To the above number of fisherman may be added an additional 230,000 potential users, an average of the expected increase in the number of fishermen within drawing radius of the reservoir during a period equal to the economic project life.

The authors of the FWS report should have considered a much smaller and more realistic area of project influence -- say 40 to 120 km (25 to 75 mi) driving distance -- as representing the principal source of potential anglers that could be reasonably expected to frequent the project. In addition, it appeared that the overly optimistic FWS angling man-day use prediction may have been further aggravated by the failure to properly assess the potential level of productivity of Allegheny Lake in relation to the amount, proximity and productivity of other waters (Lake Erie, hundreds of trout streams, etc) located within the area of project influence.

SUMMARY

The Kinzua Dam and Allegheny Reservoir project was authorized by Public Law 738, 74th Congress, approved 22 June, 1936, and Public Law 761, 75th Congress, approved 28 June, 1938. Public Law 228, 77th Congress, approved 18 August, 1941, modified the preceding acts "to include the Allegheny Reservoir project in accordance with the recommendation of the Chief of Engineers in House Document Numbered 300, Seventy-sixth Congress, first session." The project originally was constructed to provide flood control and low flow augmentation. Recreation and hydro-electric power generation functions are accommodated to the extent feasible.

The Allegheny Lake project is located in Northwestern Pennsylvania and Southwestern New York within a half-days travel distance of five large urban areas: Buffalo and Rochester, New York; Erie and Pittsburgh, Pennsylvania; and Cleveland, Ohio. Kinzua Dam, which forms Allegheny Lake is located on the Allegheny River approximately 15.6 km (9.7 mi) upstream from Warren, Pennsylvania and 319 km (198 mi) above the confluence of the Allegheny and Monongahela Rivers at Pittsburgh, Pennsylvania. About two-thirds of the lake at maximum summer pool elevation is located within the Allegheny National Forest located in Warren and McKean counties, Pennsylvania. The remaining one-third of the lake extends into Cattaraugus county, New York. Most of the land peripheral to Allegheny Lake in New York is owned and controlled by the Seneca Nation of Indians as part of the Allegany Indian Reservation.

Corps of Engineers (CE) fee ownership of lands contiguous to Allegheny Lake is limited to 1,073 ha (2,651 ac) and includes only one small 100 ha (246 ac) parcel in Pennsylvania, which is located in the vicinity of Kinzua Dam, and 12 scattered tracts ranging in size from 0.3 to 259 ha (1, to 640 ac) in New York. Each of these CE owned parcels in New York marks a location where the lake level at full pool extends beyond the Allegheny Indian Reservation. Through a license issued by the CE in 1976, administrative control of seven of these federal owned parcels, totalling 336.2 ha (830.7 ac) was transferred to the Allegheny State Park and Recreation Commission. Another small 144.5 ha (357 ac) tract was leased to Cattaraugus county, New York in May, 1976. Land acquisition for the Allegheny project began late in 1959. Construction of the dam was initiated in 1961 and completed in 1965. Impoundment began in 1966.

Allegheny Lake covers 4,876.6 ha (12,050 ac) at average summer conservation pool elevation 404.8 m (1,328 ft) mean sea level (msl) and inundates approximately 43 km (27 mi) of the original Allegheny River bed. Maximum depth is 39.6 m (130 ft). At maximum flood pool elevation 4,151.1 m (1,365 ft) msl, the surface area of the lake may increase to 8,750 ha (21,175 ac) and contain a total water volume of approximately 145,560 hectare-meters (1,800,000 ac feet). The five-year flood frequency elevation is 408.4 m (1,340 ft) msl.

An attempt is made to maintain the lake at summer conservation pool

elevation beginning in May and continuing into July. During average water years, the lake level is gradually lowered in July and may drop 2.9 m (9.5 ft) by Labor Day in order to accommodate downstream low-flow augmentation objectives. Although no formal winter conservation pool level is regularly maintained, the lake may be lowered as much as 12.2 m (40 ft) by December to provide essential flood storage capacity during the winter and spring.

The outlet works consist of 8 sluices through the dam, 6 at invert elevation 367.3 m (1,205 ft) and 2 at invert elevation 396.2 m (1,300 ft) with their inlets protected by trash racks. The sluices are controlled by 1.75 x 3.0 m (5'8" x 10'0") slide gates which are operated hydraulically from within the dam. The upper sluices are controlled by one gate each and the lower sluices are controlled by one service and one emergency gate each. The two upper sluices are used primarily during the late spring and summer months in order to provide the highest possible water release temperature to the tailwater.

A 400,000 kw capacity power station is located immediately downstream from the south abutment of the dam. The power station is operated jointly by the Pennsylvania Electric Company and the Cleveland Electric Illuminating Company. The facility houses two reversible turbines which permits pumping water from Allegheny Lake during weekends and at night into a specially constructed 40.7 ha (100 ac) storage reservoir located some 243.8 m (800 ft) above the power-house. During peak-load periods,

the water stored in the upper reservoir is released through the reversible units, now operating as turbines and generators, to produce electric power. After passing through the generators, the water is discharged either in Allegheny Lake or directly in the Allegheny River below the dam in accordance with downstream river flow requirements as determined by the CE.

Fish and wildlife resource related aspects of the Allegheny Lake project were initially described in an August, 1958 Fish and Wildlife Service (FWS) report. Information presented in this detailed FWS report was used extensively to document the subsequently issued May 9, 1961 FWS final letter report and May 9, 1961 FWS substantiating report.

As delineated by the FWS, the immediate project impact area comprised a total of 8,750 ha (21,175 ac) located below maximum design flood pool elevation 416 m (1,365 ft) and included approximately 7,905 ha (19,533 ac) of land and 665 ha (1,642 ac) of water.

Project lands were almost equally divided between Pennsylvania [3,665 ha (9,055 ac)] and New York [4,240 ha (10,478 ac)]. The water area within the project impact area included approximately 56 km (35 mi) of the Allegheny River plus 37 km (23 mi) of tributary trout streams located upstream from the proposed Kinzua Dam site. Fishery resources were expected to be affected over an additional 105 km (65 mi) of the Allegheny River below the dam as a result of alteration of stream flow and temperature regimes associated with project operation.

Pre-impoundment stream fishery and terrestrial wildlife resources in the general area of the Allegheny Lake project were characterized as significant in all reports. The Allegheny River, in particular, supported an excellent recreational fishery for smallmouth bass and other highly prized warm water species. The project area was described as one of the most important white-tailed deer producing and deer hunting areas in both Pennsylvania and New York. Black bear, wild turkey, ruffed grouse, squirrel, and cottontail rabbit were also important components of the wildlife resources found within the project impact area. Waterfowl, woodcock and shore birds were found in small numbers within the project area primarily as migrants. The size of the breeding population was low.

Project lands in Pennsylvania transferred by the CE to the U.S. Forest Service (USFS) were consolidated within the contiguous Allegheny National Forest to form a single management unit designated as the Allegheny Reservoir Composite which currently is managed by the USFS. This much larger project impact area consists of a total of 34,274 ha (84,691 ac) and includes 30,735 ha (75,944 ac) of land and 3,540 ha (8,747 ac) of water.

Lands suitable for wildlife within the project impact area in New York are situated almost entirely within the Allegany Indian Reservation. The Seneca Nation of Indians exercises complete autonomy over hunting, fishing and other wildlife-oriented activities on reservation lands and

that portion of Allegheny Lake contiguous to the reservation. The project impact area within the Allegheny Indian Reservation comprises some 2,298 ha (5,678 ac).

Management of wildlife populations and/or wildlife habitat on reservation lands has been minimal since impoundment of Allegheny Lake. The primary management thrust has been directed to improving the lake access, boating and camping facilities, and related recreational amenities. Special licenses must be obtained from the Seneca Nation of Indians to hunt or fish on Allegheny Indian Reservation lands and waters. Free licenses are available to reservation residents and other members of the Seneca Nation of Indians. Non-Indians must purchase licenses from the Seneca Nation of Indians to hunt or fish.

Lands providing wildlife habitat within the immediate project impact area remaining after impoundment of Allegheny Lake include all lands [3,672 ha (9,073 ac)] between summer lake conservation pool elevation 404.8 m (1,328 ft) and the top of the maximum flood control pool. Approximately 78 percent, 2,858 ha (7,062 ac), of the land area available for wildlife is located in New York with the remainder, 814 ha (2,011 ac), located in Pennsylvania. All but 560 ha (1,327 ac) of project land within the immediate project impact area in New York is located within the Allegheny Indian Reservation. Overall losses of terrestrial wildlife habitat within the project impact area amounted to 4,233 ha (10,460 ac), or approximately 54 percent of the total project impact area. Habitat losses were more severe in Pennsylvania sector (78 percent) than in

New York (33 percent).

The authors of the May 9, 1961 FWS report predicted that the total number of hunter man-days spent on the project impact area would decline by approximately 46 percent (from 5,169 man-days without the project to 2,811 man-days with the project in place) as compared to a 54 percent overall reduction in habitat. The monetary value of the hunter man-days spent within the project impact area was predicted to decline from \$13,527 without-the-project to \$6,318 with-the-project in place. The most severe reduction in hunting effort within the immediate project impact area was predicted to occur in the Pennsylvania portion (from 4,290 man-days per year without the project to 2,037 man-days per year with the project in place). Hunting man-days effort for white-tailed deer in the Pennsylvania sector of the impact area was expected to experience the steepest decline (78 percent) as compared to 24 percent for wild turkey and 46 percent for small game.

However, the FWS predicted that the additional hunting effort expected from improved hunter access planned for contiguous areas of the Allegheny National Forest in Pennsylvania, would fully compensate the loss of hunter man-days incurred in the immediate project impact area. An analysis of available post-project hunter use data tended to verify this FWS prediction. For example, the number of hunting licenses sold in the two counties bordering the project (McKean and Warren counties) in post-project years averaged some 20 percent higher than in pre-pro-

ject years. This increase in hunting license sale was accomplished in spite of an overall human population decline in the two counties during post-project years.

Further indications of increased post-impoundment hunting pressure was indicated by the 82 percent increase in total white-tailed deer harvest (67 percent for antlered deer) recorded by the Pennsylvania Game Commission (PGC) during post-project years. The number of white-tailed deer harvested per license also increased by some 48 percent in post-impoundment years, suggesting that the increase noted in deer harvest might be attributed to an increase in deer density and/or improved hunter access as well as to an increase in overall hunting effort.

Hunting effort in New York was predicted to decline from an average of 879 hunter man-days per year without the project to 774 man-days per year with the project in place. This prediction was not supported by post-impoundment observations. Based on the number of hunting licenses issued by the Seneca Nation of Indians, and with the assumption that each license holder hunts 7.5 times per year, estimated post-project hunter man-day use within the New York sector of the project impact area was substantially higher than predicted in the May 9, 1961 FWS final report. The average annual post-project hunting effort estimates of 3,000 hunter man-days per year (including 1,350 man-days per year by Indians and 1,673 man-days per year by non-Indians) was almost four times greater than the 774 man-days per year predicted by the FWS.

Considering only non-Indians hunting participation, post-project hunting effort was more than twice as great as predicted.

In fact, the estimated post-project hunting effort expended in the New York sector alone (3,000 man-days/year) was greater than the 2,811 man-days/year predicted by the FWS for the entire project impact area in both New York and Pennsylvania.

It is noteworthy that the substantially lower hunting effort assessed by the FWS for the New York segment [amounting to only 0.2 man-days/ha (0.08/ac) as compared to 1.2 man-days/ha (0.47/ac) for the Pennsylvania sector of the project impact area], reflected the questionable omission of hunting by residents of the Allegany Indian Reservation. This narrow FWS interpretation of the objectives in wildlife planning reports, i.e. restriction only to recreational hunting aspects -- appears to be completely inappropriate for satisfaction of fish and wildlife resource planning responsibilities pertinent to water resource development projects.

The FWS estimated that a total of 82 km (51 mi) of stream habitat above the proposed Kinzua Dam site [including 45 km (28 mi) of the Allegheny River and 37 km (23 mi) of trout streams] would be eliminated by project construction. The annual recreational fishery supported by these stream resources amounted to some 19,800 man-days valued at \$51,900. An additional 122,100 man-days per year, valued at \$366,300, were estimated from the 105 km (65 mi) stretch of the Allegheny River below

Kinzua Dam for a total estimated angling pressure within the project impact area of 141,900 man-days per year valued at \$418,100.

With the project in place, the FWS predicted that the Allegheny Lake fishery would provide some 120,500 angler man-days per year over the 50-year life of the project without special lake access development. With extensive lake access development, the FWS predicted that the post-project lake fishery could be more than doubled (from 120,500 to 300,000 angler man-days per year).

If (as recommended in the May 9, 1961 FWS report) the temperature of the water discharged from Allegheny Lake was held as nearly as possible to 12.8 degrees C. (55 degrees F.), the FWS predicted that the Allegheny River tailwater would support a total of 289,600 angling man-days valued at \$868,000. This level of angling pressure was considerably higher than the FWS predictions of 252,700 man-days value at \$758,100 with lake discharge temperature held around 15.5 degrees C. (60 degrees F.), as recommended by the Pennsylvania Fish Commission, and/or 195,000 man-days valued at \$585,000 under a 7.2 degrees C. (45 degrees F) discharge temperature regime.

The 12.8 degrees C. (55 degrees F.) tailwater discharge temperature regime recommended by the FWS was expected to provide temperatures suitable for trout over the first 72 km (45 mi) of the 105 km (65 mi) stretch of the Allegheny River tailwater within the project impact area. The remaining 32 km (20 mi) was expected to remain as excellent small-

mouth bass habitat. All 105 km (65 mi) of the tailwater would be converted to trout habitat under a 7.2 degrees C. (45 degrees F.) temperature regime. The FWS predicted that about 48 km (30 mi) of the upper Allegheny River tailwater would support trout with the remaining 56 km (35 mi) suitable for smallmouth bass under a 15.5 degrees C. (60 degrees F.) discharge regime.

The authors of the May 9, 1961 FWS report completely ignored the wishes of the PFC regarding the type of tailwater fishery desired in the Allegheny River below the Kinzua Dam. Instead of supporting PFC requests for a warmwater tailwater fishery, much of the body of the May 9, 1961 FWS letter report and appended substantiating report dealt with measures designed to provide for and/or justify a cold water (trout) fishery in the tailwater. The FWS report recommended that the temperature of water released from the project be intermediate between surface and bottom in order to provide cold water [12.8 degrees C. (55 degrees F.)] suitable for trout. The FWS report recommendation for construction of a National Fish Hatchery in conjunction with the project was intended primarily to provide trout for stocking the tailwater. Although this hatchery subsequently was constructed, none of the fish raised have been stocked in the tailwater. In fact, fish production from this facility historically has been earmarked for distribution outside the project impact area.

However, the CE subsequently implemented post-project water discharge regimes designed to duplicate natural pre-project river temperatures

downstream in-so-far as possible in conformity with the request of the PFC for maintenance of a warmwater fishery in the Allegheny River below the project.

Post-impoundment partial creel survey estimates and investigation conducted by the PFC and FWS indicate that water quality, fish population and fishing pressure in the Allegheny River tailwater have not been adversely affected by project construction. In fact, evidence of small-mouth bass reproduction has been obtained throughout the tailwater. Trophy size brown trout, muskellunge and walleye are commonly creeled in the 11 km (7 mi) stretch of the tailwater immediately below Kinzua Dam. The seasonal increase in late spring and early summer water temperatures have been delayed somewhat over pre-project conditions, and the decline in fall and early winter stream temperatures has been delayed in the immediate tailwater section. However, project effects on Allegheny River temperature are negligible below Irving, Pennsylvania, located approximately 25 km (16 mi) below the dam.

FWS predictions of post-project angler man-day use of Allegheny Lake have proven to be overly optimistic. The May 9, 1961 FWS final report predicted that the lake would provide a minimum of 120,500 man-days of angling per year if no access facilities were provided at the project, and some 300,000 man-days per year if special access facilities were constructed. In fact, however, the lakewide creel survey conducted by PSU from April 1, 1979 through March 30, 1980, indicated that Allegheny Lake supported less than 20,000 man-days of angling per year, or some

83 percent under the minimum FWS report prediction and/or some 93 percent under the maximum FWS report prediction.

Information is available which suggests that the 1979-80 fishing season was atypical because of critical gasoline shortages and an unusually cold and wet summer which inhibited fishing participation during the year. However, even with acceptance of the highly unlikely assumption that fishing pressure in the 1979-80 season was only half of normal, the May 9, 1961 FWS prediction of annual angler man-day use (300,000 man-days) appears to be grossly exaggerated.

The authors of the FWS report should have considered a much smaller and more realistic area of project influence -- say 40 to 120 km (25 to 75 mi) driving distance -- as representing the principal source of potential anglers that could be reasonably expected to frequent the project. In addition, it appeared that the overly optimistic FWS angling man-day use prediction may have been further aggravated by the failure to properly assess the potential level of productivity of Allegheny Lake in relation to the amount, proximity and productivity of other waters. (Lake Erie, hundreds of kilometers (miles) of trout streams, etc.) located within the area of project influence.

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